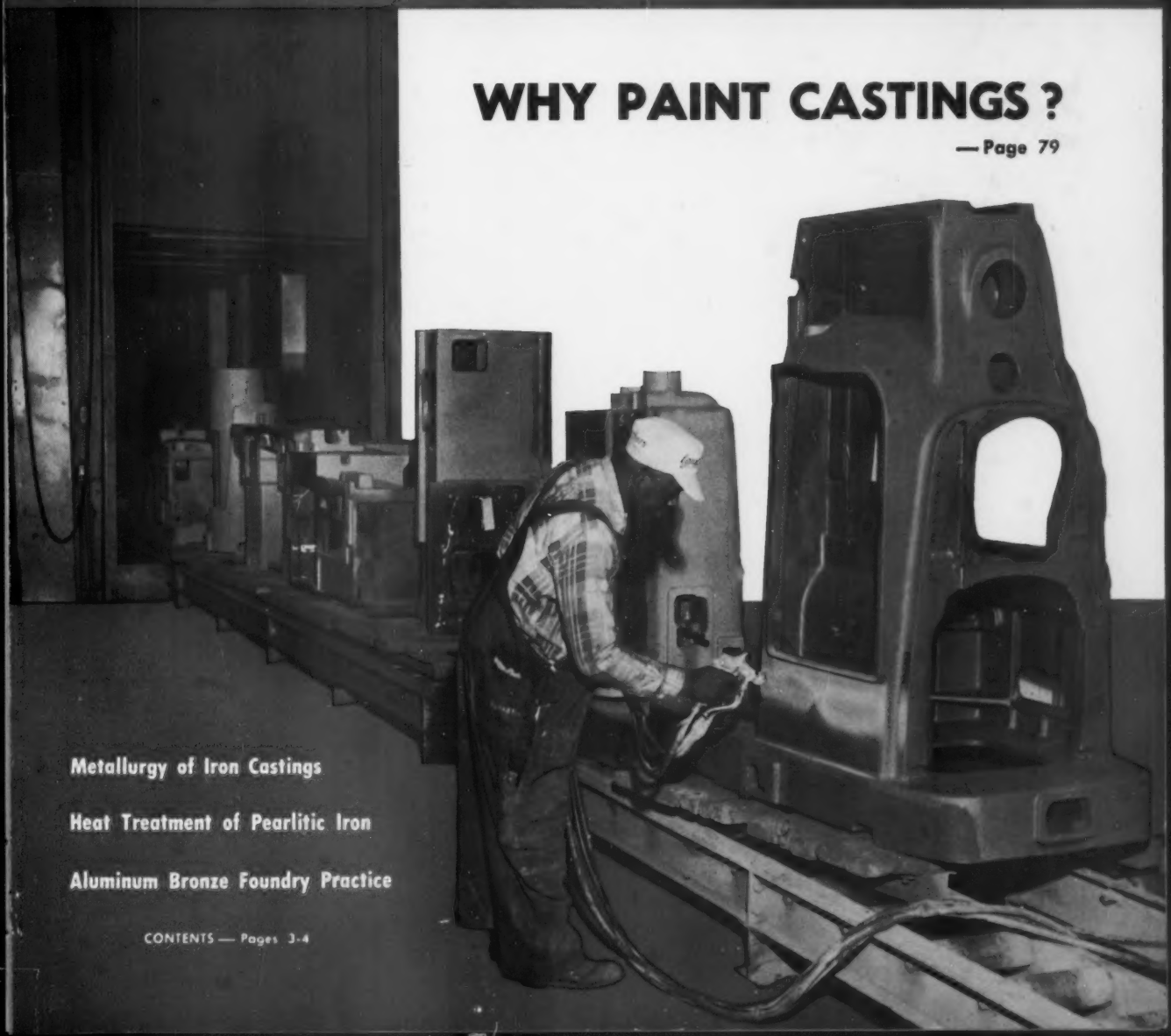
APRIL
1960

FOUNDRY

A PENTON PUBLICATION

WHY PAINT CASTINGS?

— Page 79



Metallurgy of Iron Castings

Heat Treatment of Pearlitic Iron

Aluminum Bronze Foundry Practice

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METALGRAMS

. . . news about "Electromet" ferroalloys and metals

UNION CARBIDE METALS

APRIL, 1960

PLUNGING GROWS -- Ductile iron producers are showing more interest in the higher and more uniform magnesium recoveries obtained by plunging the magnesium-bearing alloy into molten iron in the ladle. Union Carbide Metals now offers two low-cost alloys for plunging -- "EM" magnesium-ferrosilicon (10 per cent magnesium) and "EM" alloy 55 (30 per cent magnesium). Both are specially sized for plunging. Among the advantages of plunging are magnesium recoveries up to 60 per cent, better structure control, less pyrotechnics, and lower costs. For further details, write for a new six-page folder, F-20,120.

* * *

FASTEST-DISSOLVING FERROCHROME -- Stainless steel melters continue to be impressed with the rapid solubility of the new "Simplex" low-carbon ferrochrome. In a typical test, 3,300 lbs. of the alloy (7.7 per cent chromium added) dissolved in a 15-ton heat after refurnacing in less than 25 minutes. In addition, 500 lbs. of "Simplex" ferrochrome added to the ladle during refurnacing dissolved before the ladle was half full. Get further information in a new six-page folder, F-20,118.

* * *

DOWN GOES THE IRON -- By reducing the iron content of aluminum-silicon alloy castings, high strengths can be obtained with good ductility. As a result, high-purity aluminum-silicon alloys are finding increased use in structural and rotating parts of jets and missiles. For practically iron-free silicon additions, Union Carbide Metals now offers a new 0.35 per cent maximum iron grade of silicon metal in addition to the 0.50 per cent maximum iron grade. In both grades, calcium, another undesirable element, is held to a maximum of 0.07 per cent. For further information, write for the Fall 1959 issue of UNION CARBIDE METALS REVIEW.

* * *

QUALITY IN QUANTITY -- Each of the more than 100 "Electromet" ferroalloys and metals is carefully inspected during every step of production. The aim: To make sure that each alloy meets close chemical specifications consistently. Samples are taken during raw material preparation, furnacing, cleaning and crushing, packing, storage, and shipping. During an average month at Union Carbide Metals' Marietta, Ohio, plant, more than 30,000 tests are made on over 10,000 samples. For further details, ask for the Summer 1959 issue of UNION CARBIDE METALS REVIEW.

* * *

NOTCHES AID CHARGING -- For years, iron foundrymen have been adding alloy additions to the cupola charge quickly and easily with "EM" briquets. Each briquet contains a definite weight of the alloying element, in one or two pound units. As an added convenience, all "EM" briquets are now furnished in notched form so that they can be split in half. Often, half a briquet is needed for accurate additions to small cupolas. For briquet specifications, write for F-20,066.

* * *

UNION CARBIDE METALS COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Union Carbide Canada Limited, Toronto.

"Electromet," "EM," "Simplex," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

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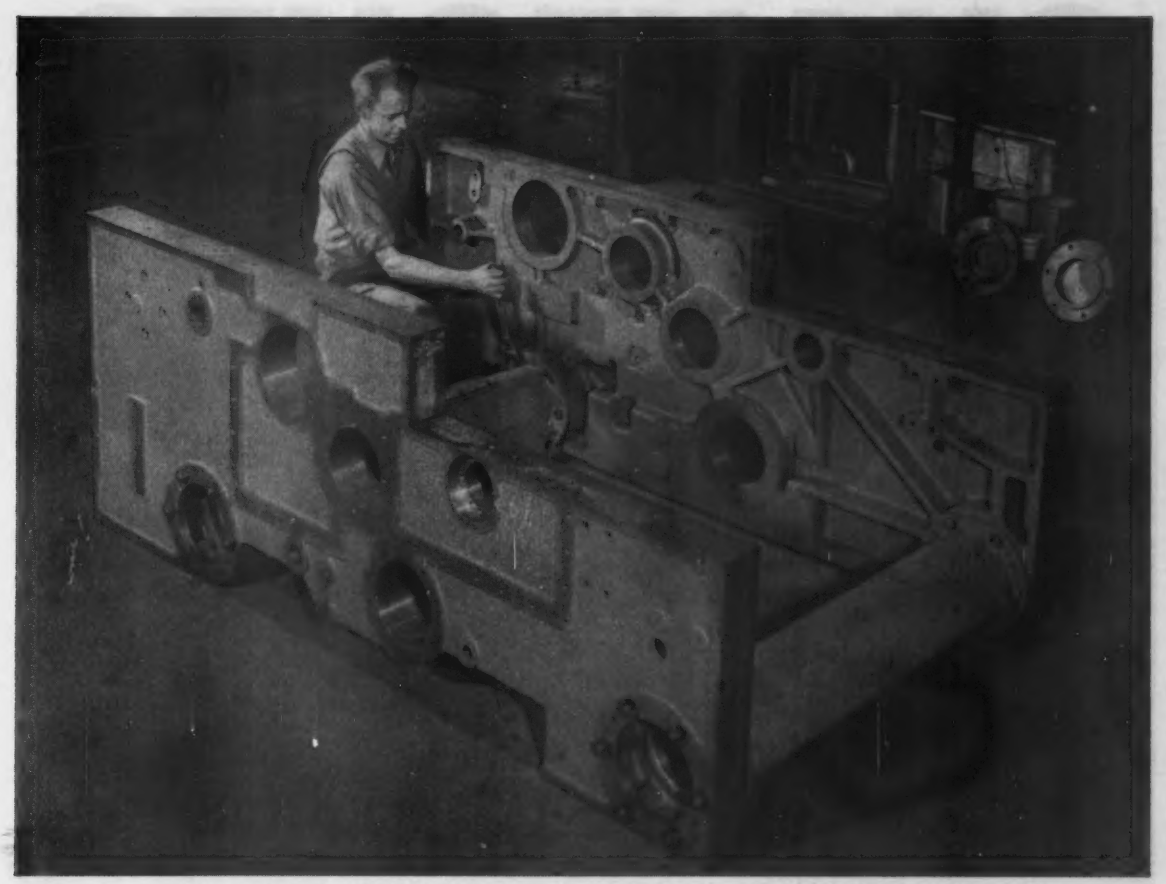

1300 pound cast frame for large high speed bag-making machine. L. Brayton Foundry Co. uses a 1% nickel cast iron for frames to assure accurate alignment of shafts and cross members during assembly by St. Regis Paper Company, East Providence.

How nickel irons help you maintain control of large, complex castings

One of the easiest ways to obtain dimensional stability in a big, intricate casting is to use a nickel cast iron.

Take the matched frame members shown above, for example.

You'll see the problem right away. Unless cored holes and to-be-machined surfaces line up almost perfectly . . . up go machining costs.

Now notice the heavy bosses and ribs. And take note that the supporting web is ½-inch thin. You would expect some chill in this web and a tendency to warp. And you might forecast a costly stress relief or expensive set-up time in machining operations.

L. Brayton Foundry got around all this quite easily. By using a nickel cast iron mix, they were able to deliver these frames "as cast" and meet all requirements for dimensional accuracy.

Nickel irons give you more control over chill...help keep warping stresses low

Nickel cast irons show less tendency to chill. With these irons, structure is more uniform. Build-up of internal warping stresses in large, complex castings is not as high.

What's more, selection of the right grade of nickel iron gives you improved control over structure, and hence, machinability, wear resistance, strength and other properties desired by you and your customers.

Pass on to your customers the benefits of nickel cast irons

Next time you have an order coming up for a large, complex casting, look into the economics of nickel cast irons. You may be able (1) to reduce your own costs or (2) to provide your customer with a much better casting.

Maybe you can do both. The way to find out is to contact Inco. Inco's engineering service can help you . . . on either a special foundry problem or to help convince a customer.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N.Y.

INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

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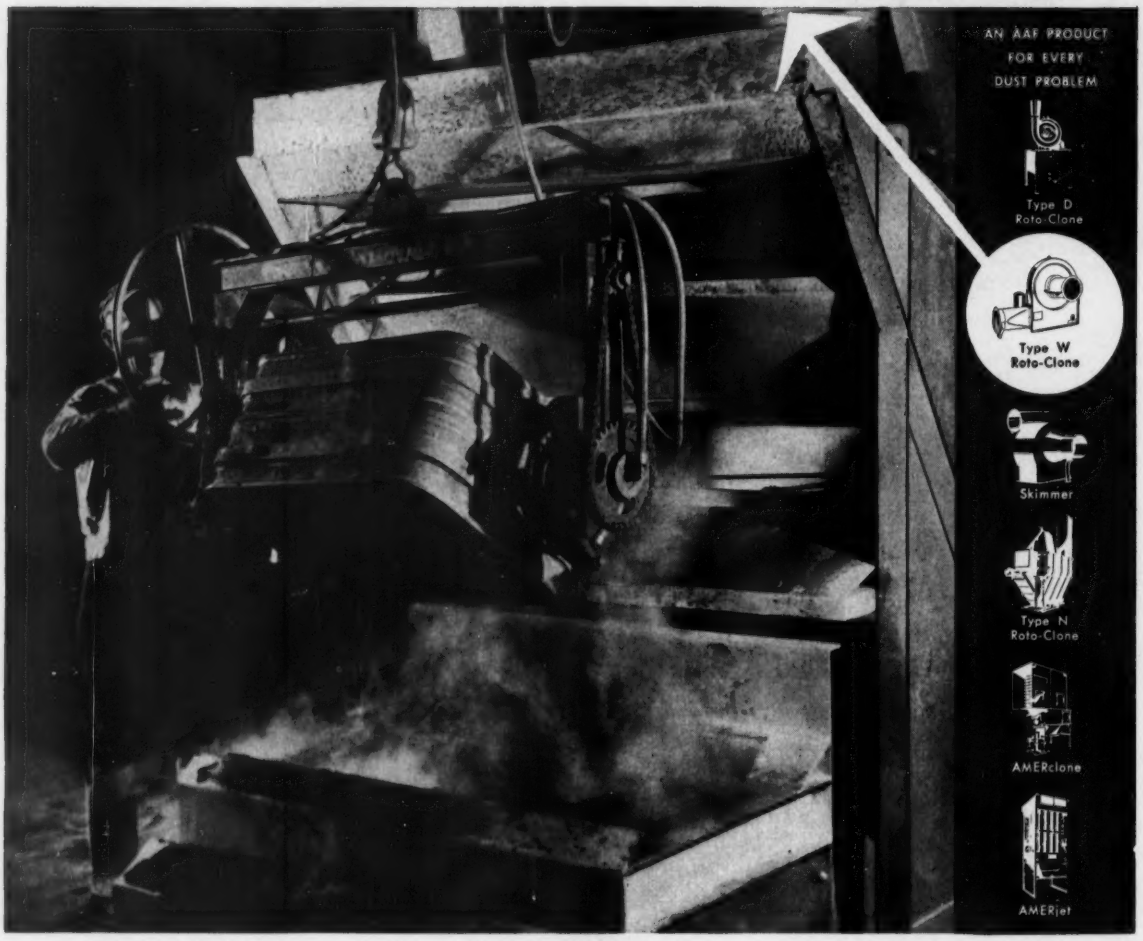
SHAKEOUTS



AAF Type W ROTO-CLONE takes shakeout dust in tow!

● AAF's wet-collecting Type W ROTO-CLONE is the No. 1 enemy of foundry shakeout dust. Its high efficiency, low cost, and small space requirement make it a "natural" for this application.

Water sprays extend the effectiveness of the Type W's dynamic forces to the collection of the very lightest and finest dust particles. It requires little maintenance, uses a minimum of water, and maintains its efficiency regardless of air volume.

AAF's complete line of dust control equipment was application-developed, now challenges *any* foundry dust problem. If *your* problem is shakeout dust, call your local AAF representative or write direct for Type W ROTO-CLONE Bulletin 274B. Address: Mr. Robert Moore, American Air Filter Company, Inc., 266 Central Avenue, Louisville, Ky.

AAF American Air Filter
BETTER AIR IS OUR BUSINESS

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April 1960
Volume 88—Number 4

FOUNDRY
A PENTON PUBLICATION

Material properties at temperatures up to 4000°F can be studied with this new type apparatus. Shown with it are Delbert H. Fisher and Gus Serio of Battelle Memorial Institute. It was developed there for use in material evaluation for the Air Force

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Managing Editor: WILLIAM G. GUDE
Metallurgical Editor: EDWIN BREMER
Associate Editors: ROBERT H. HERRMANN, JACK C. MISKE
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FOUNDRY is edited primarily for management, production, technical, and purchasing personnel in foundries. A copy is sent at no cost to each metal casting plant in the U. S. and Canada employing 20 or more workers and to selected smaller foundries. Additional copies are sent to each foundry to the extent necessary to serve all key foundry personnel on a personal or routed basis. A limited number of copies is supplied at no cost to educational institutions. Subscriptions in the U. S., possessions, and Canada for home-addressed copies and copies not qualified for under the above principles: One year, $10. Single copy, $1. Other countries: One year, $20. Single copy, $2. Published monthly by The Penton Publishing Co., Penton Building, Cleveland 13, Ohio. Accepted at controlled circulation publication at Cleveland, Ohio.

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THE EDITORS' WORKSHOP

NEXT MONTH: Foundry equipment has the spotlight in several special articles to be presented in the May issue.

An insight into expansion and modernization plans of foundries will be provided by a special study.

Want to know how the age of your principal types of equipment and the number of units you have

compare with those of other foundries of comparable size? Our inventory of foundry equipment will supply that information next month.

There's no hard and fast rule to tell you when to replace an old piece of foundry equipment, but equipment builders have some helpful suggestions in the May issue.

To get down to cases on equipment replacement, several articles will describe how foundries employ modern facilities to improve costs, production, and product quality.

PHILADELPHIA: May is the Preconvention Issue. In addition to details of the AFS Castings Congress

and Exposition to be held May 9-13, the issue will include descriptions of new and improved equipment and supplies being introduced. Much of it will be on display at Philadelphia.

From a laboratory furnace to a reverberatory furnace Hevi-Duty helps you find the value solution to your non-ferrous melting problems

Hevi-Duty's value solutions to three melting problems are described below. Such solutions call for comprehensive industrial engineering ability as proved by Hevi-Duty's success in solving thousands of heat processing problems in all types of applications.

Such solutions call for creative design engineering ability backed by Hevi-Duty's experience with industry's most complete line of electric and fuel-fired furnaces and ovens. (Where stock designs or adaptations won't do, Hevi-Duty custom-engineers equipment including huge field-erected furnaces.)

Such solutions call for soundly built and tested equipment typified by Hevi-Duty furnaces now paying off throughout industry in increased production and extended economic life of equipment.

Case histories by the hundreds testify that it makes profitable sense to call in your Hevi-Duty sales engineer to help find the value solution to your melting problems.

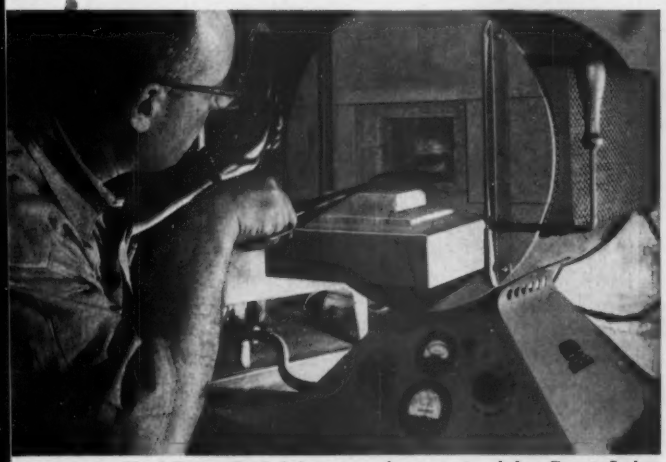
HEVI-DUTY

Electric and Fuel-Fired Industrial Furnaces and Ovens

B P C

A Division of Basic Products Corporation

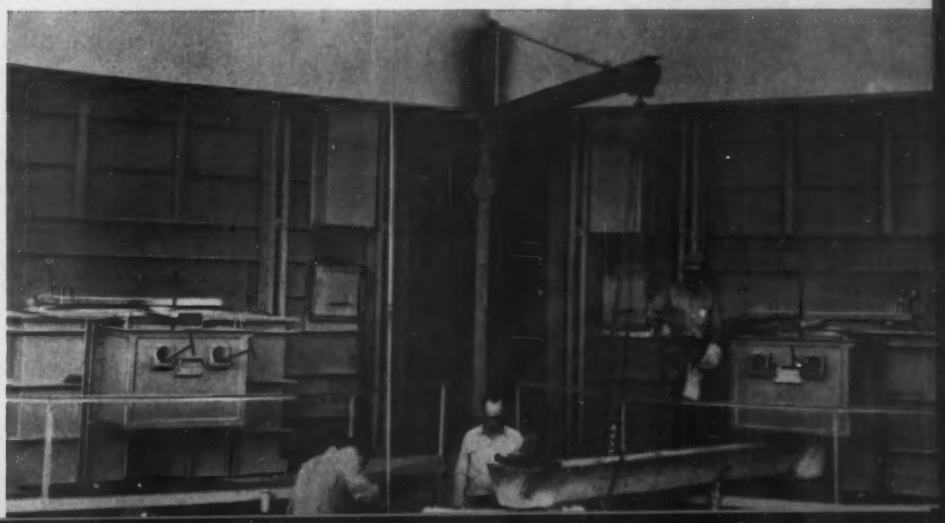
Hevi-Duty Electric Company, Milwaukee 1, Wis.



Hevi-Duty G-05 laboratory furnace used by Great Lakes Steel Corp., Detroit, for determining alumina content of slag is kept at 2200°F, 24 hours a day, 7 days a week. It heats rapidly, has 48 steps of control between 1700°F and 2600°F. Instruments and controls in base remain close to room temperature. **For more information please request Bulletin 254.**

Double-chamber dry-hearth aluminum melting furnace covers only 32 sq. ft. area at In-Sink-Erator Co., Racine, Wis., yet melts and holds up to 400 pounds of aluminum per hour after 2½-hour warm up. Well insulated furnace permits use of a permanent mold machine next to the dip-out chamber. **For complete information write for Bulletin 593.**

Each of these reverberatory furnaces melt and hold 35,000 lbs. of aluminum for direct-chill billet casting. One furnace brings melt up to temperature while other pours. Large doors permit easy bath access for charging, drossing, fluxing, alloying and furnace cleaning. **Please write for Bulletin 591.**



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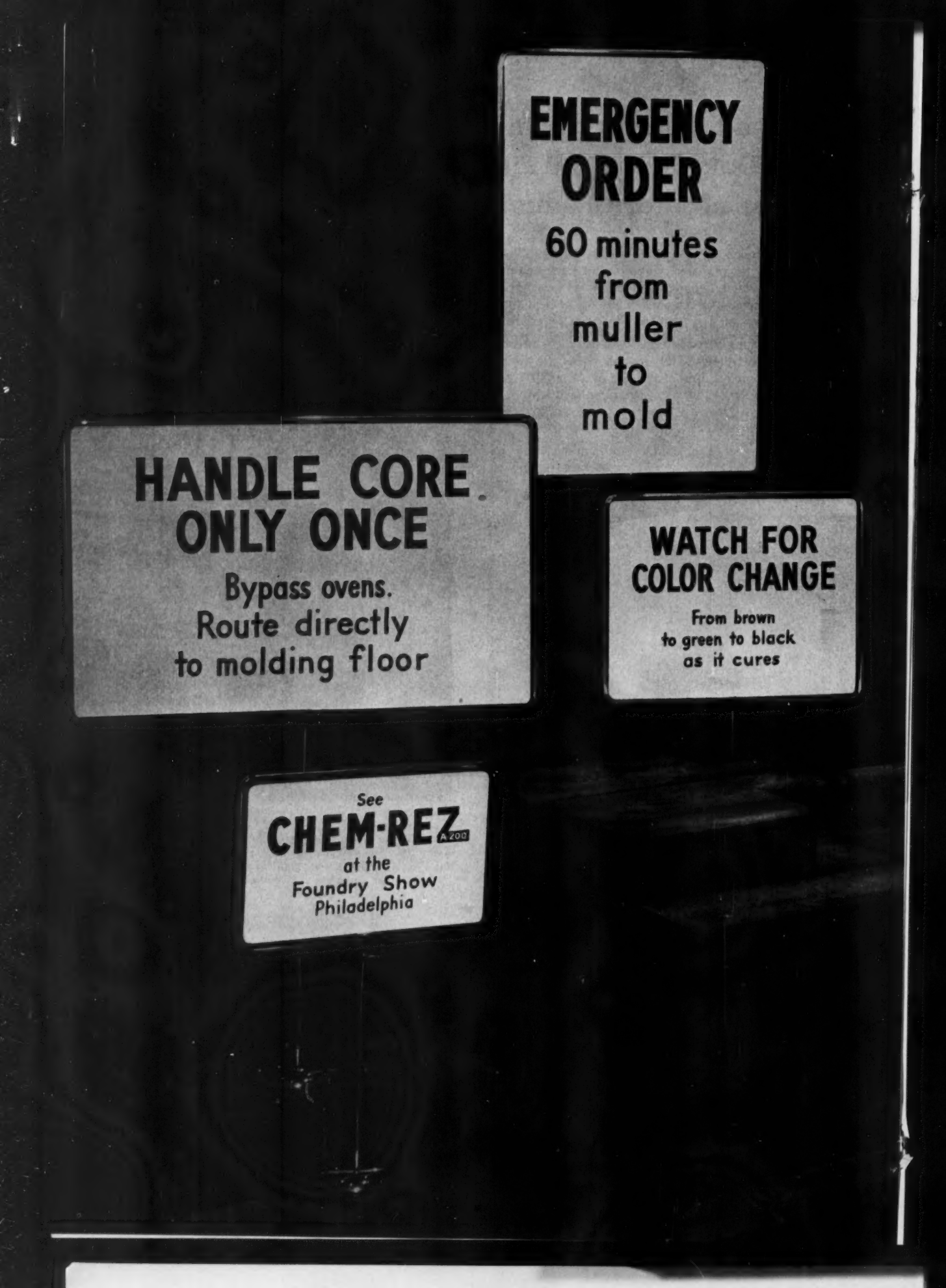
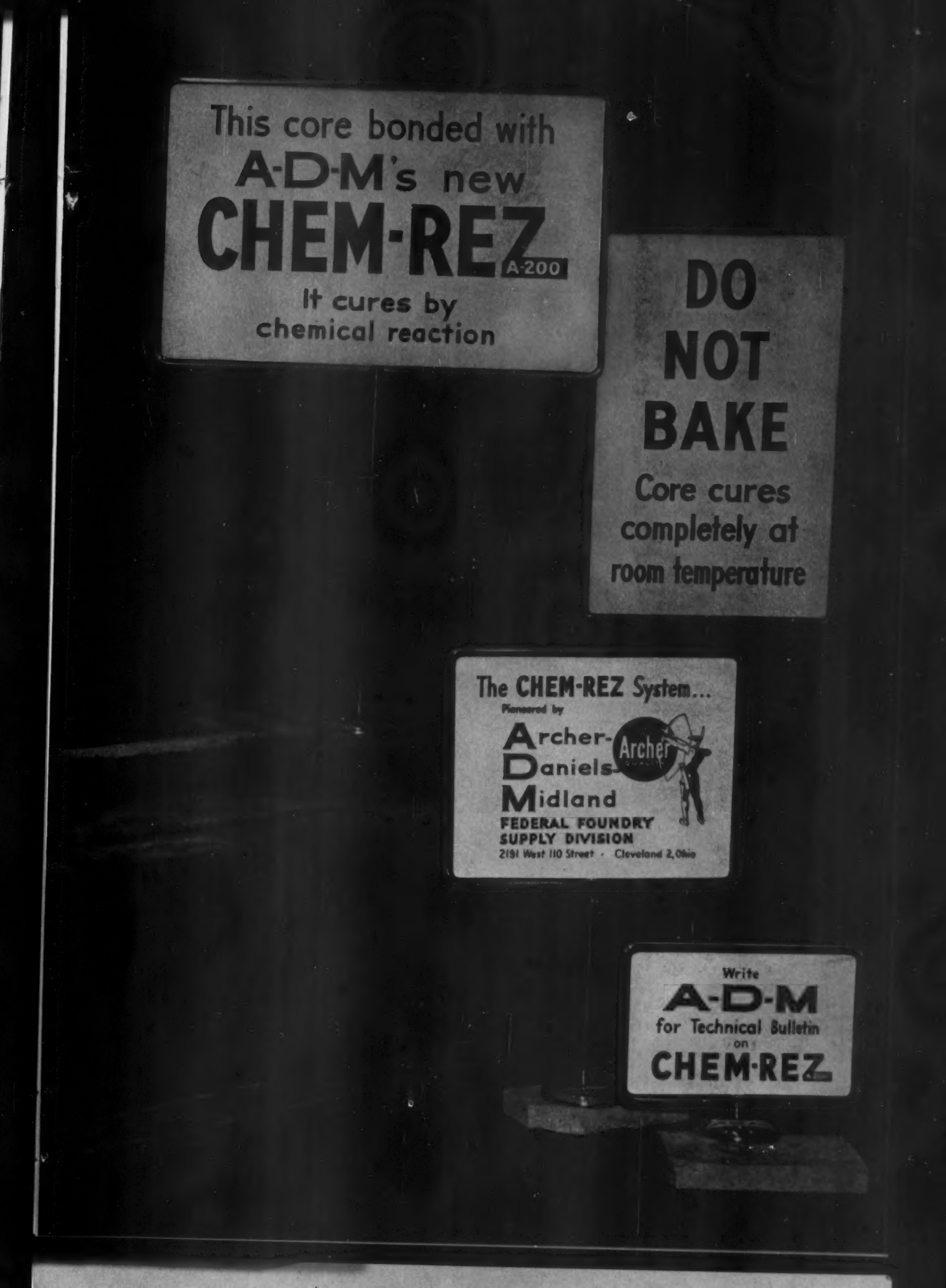
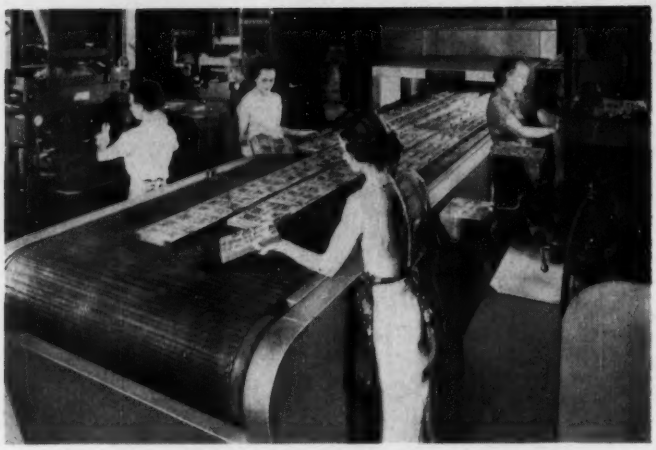
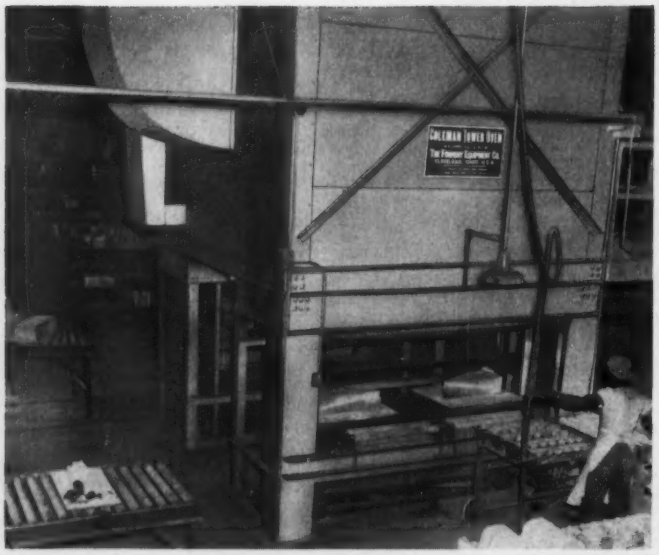

EMERGENCY ORDER
60 minutes from muller to mold
HANDLE CORE ONLY ONCE
Bypass ovens. Route directly to molding floor
WATCH FOR COLOR CHANGE
From brown to green to black as it cures
See
CHEM-REZ
AZOB
at the
Foundry Show
Philadelphia


This core bonded with
A-D-M's new
CHEM-REZ
A-200
It cures by
chemical reaction
DO
NOT
BAKE
Core cures
completely at
room temperature
The CHEM-REZ System...
Pioneered by
Archer-
Daniels-
Midland
Archer
FEDERAL FOUNDRY
SUPPLY DIVISION
2191 West 110 Street · Cleveland 2, Ohio
Write
A-D-M
for Technical Bulletin
on
CHEM-REZ

CUT LABOR COSTS with Coleman Conveyor Core Ovens



Coleman Dielectric Core Oven in leading plumbing fixture foundry. Direct labor alone reduced by 75%, with many other important savings and advantages.



One of two large Coleman Tower® Core Ovens in a major steel foundry baking cores up to 150 pounds. Self-amortizing investment . . . ovens paid for themselves out of direct annual savings in less than two years.

● Performance records in all types of foundries prove that Coleman Conveyor Core Ovens reduce core department costs by as much as 50%.

Coleman Ovens quickly pay for themselves out of direct savings in labor, materials and reduced casting scrap.

As builders of the world's only complete line of foundry ovens . . . dielectric or recirculating heat . . . we can recommend, without bias, the right oven for your particular needs.

WRITE FOR BULLETIN 54

THE FOUNDRY EQUIPMENT COMPANY • 1821 COLUMBUS ROAD, CLEVELAND 13, OHIO

World's Oldest and Largest Foundry Oven Specialists—More than half a century of specialized foundry experience.

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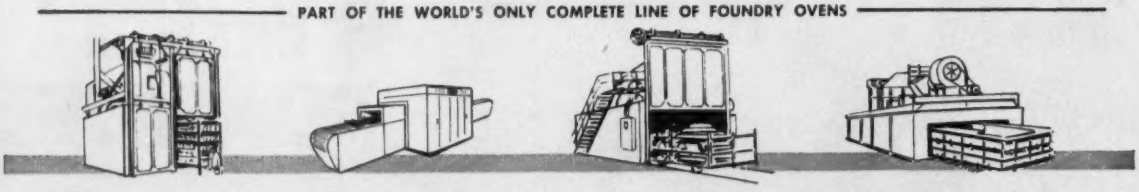

TRANSRACK OVENS | DIELECTRIC CORE OVENS | CAR TYPE OVENS | JET ACTION MOLD OVENS

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Nationwide Network of Local Service Centers!

Wherever they are, users of Towmotor-Gerlinger fork lift trucks and carriers know that the industry's fastest service is as handy as a phone call. It's one of the reasons why industrial firms have invested millions of dollars in Towmotor-Gerlinger equipment.

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Want more information on this unique Towmotor service? Ask for *Towmotor P-M Service Booklet SP-18.* Write Towmotor Corporation, Cleveland 10, Ohio.

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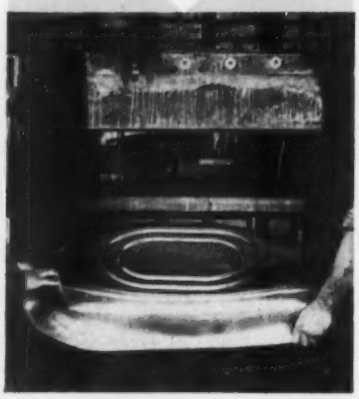
TOOLING COSTS TOO HIGH?



GOODYEAR AIRCRAFT SAVES 50% TO 75% IN TOOLING COSTS BY FORMING ALUMINUM ON HYSOL EPOXY TOOLING DIES

Goodyear Aircraft is but one example of how Hysol Epoxy Tooling cuts cost. It can help you, too. Two major factors in tooling costs are material and time. Because a Hysol Epoxy tool can be cast or laid up directly from the master mold without hand barbering or fitting, skilled labor time is cut to a minimum and expensive machinery is eliminated. To get complete information on how Hysol Epoxy Tooling can help you cut tooling costs write—TOOLING

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AFS Foundry Show May 9-13

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With the Editors

FORD FIGHTS ODORS: The *Cleveland Plain Dealer* recently carried a lengthy article under the heading, "Ford Fights Brook Park Smoke, Odor." It was a favorable article which emphasized the problem faced by the Ford foundry, and concluded that while the effort continues "a million dollars has failed to stop smoke and odors."

The problem which Ford faces is not unusual. In the early 50s, that company acquired a large tract of land near the Cleveland airport which was sparcely settled. A tremendous foundry and two large engine plants were built. As usually happens, more and more people built around the plant so that today a large number of residents are aware of the situation outlined in the article. Although not mentioned in the article, the odors from the plant are being noted 4 or 5 miles away, depending on wind direction and other factors.

Simon Lyss, manager of manufacturing engineering, was quoted as saying the odors are produced in baking sand cores. "It is the scourge of the foundry business. No one knows how to control them. We can clean up our smoke with dust extractors and other equipment, but we frankly don't know what to do about the odors."

Ernest E. Harkess, foundry manager, is reported as saying the company has hired a team of scientists from Case Institute of Technology to gather and analyze the offensive smoke to determine what causes the odors and find a remedy.

The work now being done at the plant to solve the problem was outlined as follows: "Two years ago Ford began a full-scale war on the problem. When the original machinery was installed it contained dust extraction equipment. This was found to be insufficient even when new. As the capacity of the plant increased until it was nearly double the original volume, the smoke problem grew worse.

"Under the current program seven smokestacks were raised 45 feet above their original 95-ft height. Only the restrictions imposed by the proximity of Cleveland Hopkins Airport prevented the firm from raising the stacks higher.

Two of the cupola furnaces now have been equipped with the latest dust prevention equipment, not available when the plant opened in 1952. This cost the firm $850,000. Plans for 1960-61 call for converting the other furnaces to the new system to cut down dirt in the smoke."

—o—

Never Die: The Steel Founders' Society of America has sent out the accompanying illustration and a news release, under the heading "Such Carrying on—By a Steel Casting" the story goes on to say that old railroad truck side frames

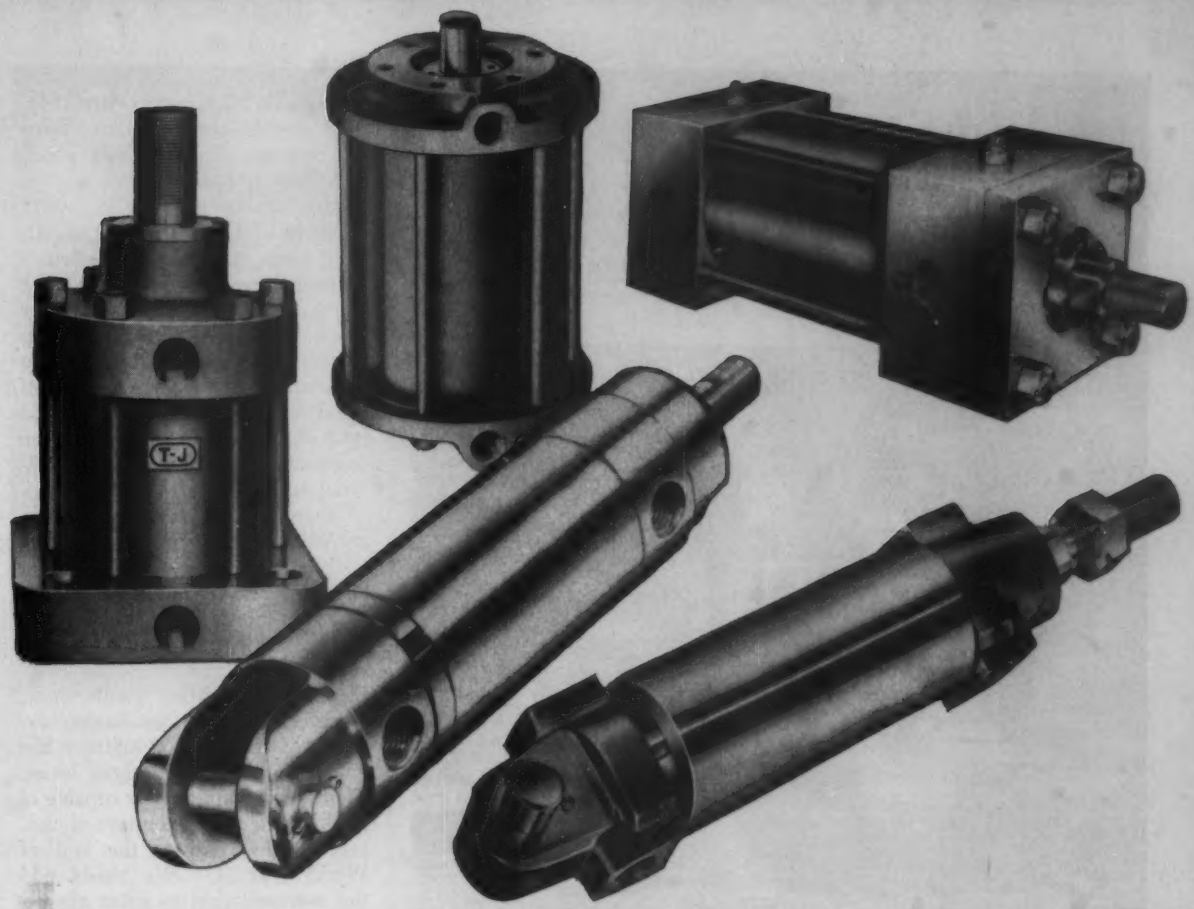
never die—they just keep carryin' on, or so it would seem.

This railroad truck side frame was cast in March, 1916 and has seen 40 years of service under a 70-ton freight car. The car proper was rebuilt in July, 1959, indicating a life expectancy of about 70 years for the side frame and the other three on the car, which also were cast in 1916.

The society points out that this is not an isolated case since in 1959 several thousand heavy-duty freight cars were rebuilt using cast steel side frames of similar vintage and past service.

—o—

New Record: Since May 1, 1958 the men and women of the Cleveland sand foundry, Aluminum Co. of America, have worked nearly 1½ million manhours without a lost-time accident. Over 770,000 of those hours were in 1959, for which the plant has been awarded a special plaque, poured in its own foundry from its own patterns. The plaque recently was presented to the sand foundry. It was accepted



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That Can Assure *Accurate Efficient Operation*

Only T-J's complete line can assure you a cylinder of either air or hydraulic application—with practically limitless design specifications for bore, stroke, pressure range and even delivery requirement. From the time-tested, standard tie-rod air and hydraulic, to the exclusive T-J Spacemaker, and including the recently introduced Squair Head, T-J cylinders give you more features for efficient, long-lasting operation. Write today!

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H-47 for standard tie-rod hydraulic cylinders.

SQ-1058-4 for the T-J Squair Head cylinder.

No. 54 for standard tie-rod air cylinders.

SM-56-3 for the incomparable Spacemaker cylinder.

HSM5-56-4 for the High-Pressure Hydraulic Spacemaker cylinder.

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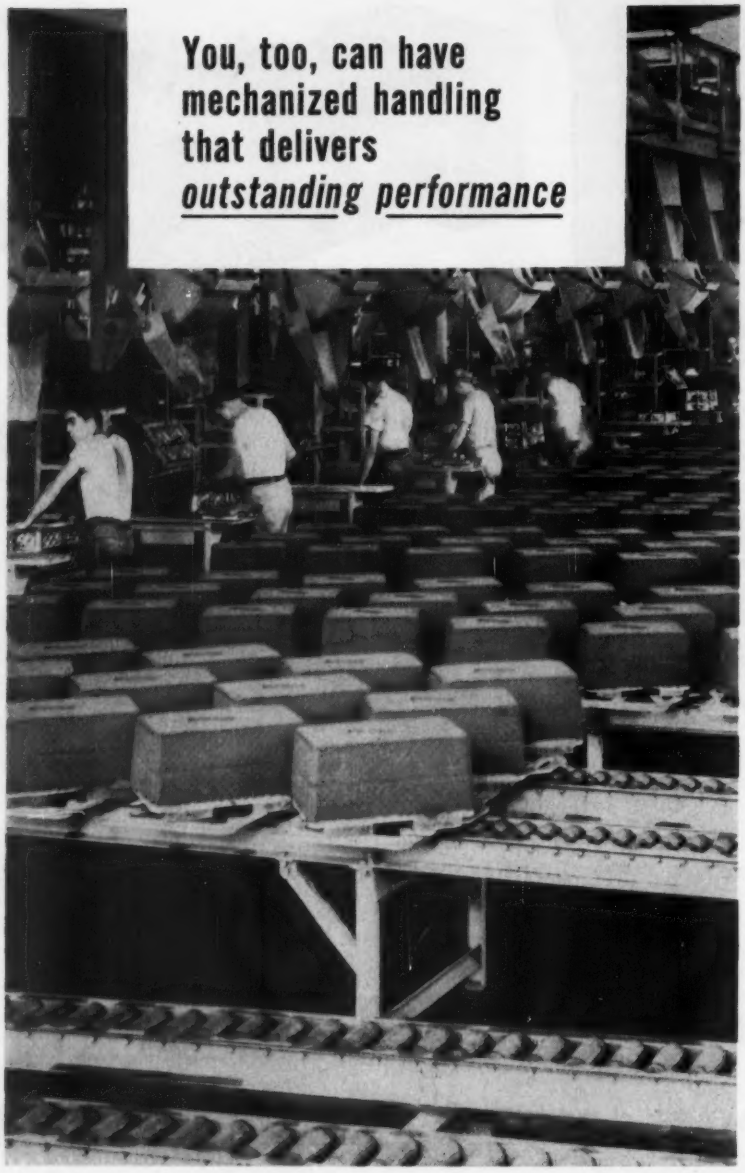
You, too, can have mechanized handling that delivers *outstanding performance*



• Whatever your conveying problem might be — whether it involves the handling of light or heavy unit loads — Mathews will build the **right** equipment for you. You'll get a fully integrated conveyer service, and a system which delivers outstanding performance.

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Port Hope, Ontario, Canada

(Member Foundry Equipment Manufacturers Association)

MATHEWS

Manager A. H. Hinton (Page 184).

Congratulations to management and workers of the Alcoa plant. This is a splendid record.

—o—

Plenty of Life: In the Dec. 31, 1959 issue of our worthy British contemporary, *The Foundry Trade Journal*, Editor Vincent Faulkner has an editorial, "Fewer American Foundries," in which he discusses the results of FOUNDRY's study of statistics provided in the 1959-60 issue of Penton's Foundry List. The concluding paragraph of the editorial is as follows:

"Frank G. Steinebach, commenting editorially in FOUNDRY on these statistics, wisely states 'The trend towards a smaller number of foundries continues. Production statistics and information on new foundries and mechanization and modernization of existing plants show, however, that the production capacity of the foundry industry has not been affected by these losses. The industry probably is capable of producing a greater tonnage of castings yearly than at the end of World War II.' We would add the comment that as gains are being shown in die-castings, precision and magnesium castings, that the value of the output is steadily increasing. There is plenty of life in the old dog yet!"

Some of my friends have questioned whether the esteemed English editor refers to the American foundry industry or to the editor of FOUNDRY in that last sentence.

—o—

For the Small Shop: FOUNDRY has talked on numerous occasions about the importance of having available equipment designed primarily for use by smaller foundries. This makes a recent announcement of Beardsley & Pipe Division, Pettibone Mulliken Corp. of particular interest to us.

B & P has developed a new sales program to promote and sell a complete line of its smaller equipment, to be known as the Foundry-Mite line. The equipment includes bench and floor model Vibra Draws, wire straighteners, wire cutters, electric riddles, jolt squeeze machines, and Screenarators. The first public showing of the equipment as a line will be at the AFS Casting Congress and Exposition, Philadelphia, May 9-13. F.G.S.

Above: This battery of Detroit Rocking Electric Furnaces supplies melted metal of uniform high quality to the Detroit Controls conveyorized casting line. Right: D. Wesley Case, foundry superintendent at the Stratford, Connecticut, plant, Detroit Controls Division, American-Standard Corp.

"Once the controls are set, Detroit Electric Furnaces **automatically** regulate for the most efficient performance."

Here's a new plant, planned and equipped for production line efficiency in the manufacture of brass and bronze valves and specialties. And to furnish melted metal of highest quality at speeds to match the efficiency of the rest of the plant, Detroit Controls Division of American-Standard Corporation chose Detroit Rocking Electric Furnaces.

"These furnaces," says D. Wesley Case, foundry superintendent, "practically eliminate the human element, with its possible errors, from the metal-melting process. Once the controls are set, the furnaces themselves regulate the degree of rocking and maintain the proper arc for the most efficient performance."

Fast, economical melts of uniform high quality and exact analysis are produced by Detroit Rocking Electric Furnaces in hundreds of foundries across the country. There's a size and type that's right for you, too. Find out now!

DETROIT ELECTRIC FURNACE DIVISION

Kuhlman Electric Company • Bay City, Michigan

Foreign Representatives: in BRAZIL—Equipamentos Industrias, "Elsa" Ltd., San Paulo: CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 38, N. Y.; MEXICO: Cia Proveedora de Industrias, S.A. Apartado Postal No. 2783, Mexico 7, D.F., Mexico.

Furnace being loaded with 750 lbs. of bronze-based ingots. Only two men operate the battery of furnaces.

45 minutes from 750 lbs. of ingots to 750 lbs. of metal ready for the molds.

A mechanized line like this needs a constant supply of metal. And Detroit Electrics keep the ladles full.

Circle 563 on Page 53

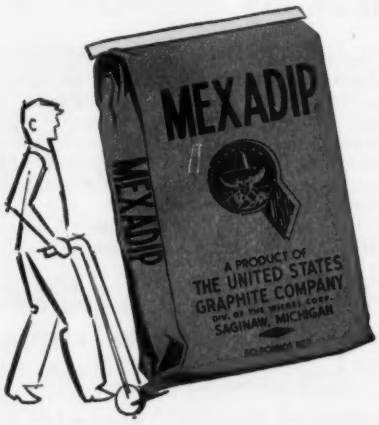
WASHES · WAS

no matter what the application . . . there is Mold Wash for every foundry need . . . or

SIPAC®

with only the addition of water, produces a bright, gold-colored coating with fine, smooth surfaces, using any foundry sand. It's non-carbonaceous and inert and will not react with any molten metal, including grey iron and steel. Resists flaking and completely protects core surfaces. You get improved casting quality. Sipac is available in 55 gallon drums, ready for mixing and dilution to desired Baume — even to a scale of 32 — without settling.

MEXICAN® VV FLAKE ("volatile vehicle")— meets the growing demand for good mold and core wash suited to carbon dioxide mold-core hardening process. Completely compatible with isopropyl alcohol, oleum spirits, kerosene or similar agents, Mexican VV Flake provides extra refractory protection . . . improves skin hardness . . . gives better casting quality. Comes in paste form, suitable for application by spraying or dipping.



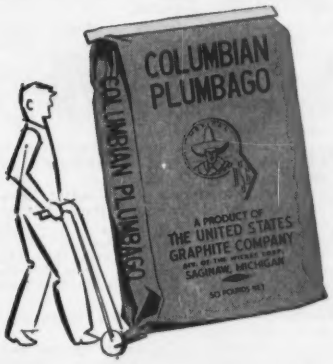
MEXADIP® — refractory core coating containing its own binder, requires only water to prepare it for use. Will not ferment, produces a very uniform, even coating over entire core with practically no sagging, running or dripping. Use it throughout foundry for green or baked cores, ferrous or nonferrous foundry practice.

THE UNITED STATES

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® POWDER METALLURGY • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

HES · WASHES

a United States Graphite Company Core or one may be engineered to your requirement



MEXICAN® COLUMBIAN PLUMBAGO—versatile wet blacking used for loam work, green or dry sand or torch dried molds where soft coat with high resistance is required. Suitable for all types of castings, including those of over 25 tons, high steel mixtures and castings poured at high temperatures.

SLICK RITE®— compounded from a base of high quality flake graphite to produce best slicking qualities, Slick Rite is applied to green sand molds by hand rubbing, tooling or brushing. Excellent casting quality obtained when mixed with water and molasses to produce wet lead for spraying molds and cores.

MEXICAN® 172—high refractory wet blacking with binder. For application to both molds and cores of heavy sectioned castings where best possible finish is required under severe pouring conditions.

No. 866®—is a wet blacking without binder. Provides soft coating with good refractory properties for molds and cores of medium and light sectioned castings. Also makes good blacking for bell end cores in pressure pipe manufacture. Can be applied by spraying, brushing or swabbing at 40-45 Baume.

MEXICAN® 700 — is particularly suitable for large molds and dry sand cores of high carbon iron such as cast iron rolls and ingot mold castings poured at intermediate temperatures. Contains no binder.

Write today for engineering bulletin No. 17 giving complete details and application methods of core and mold washes for all ferrous and nonferrous foundries.

GF-244-2

GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW 14, MICHIGAN

Circle 564 on Page 53

WHY PAY MORE

when you can buy the best binder at the lowest price!

INSIST ON STEINEX

the original CO_2 Binder available

only from Carver

BEST QUALITY Steinex gives you absolutely the best shakeout —BY FAR!

BEST PRICE Steinex is 30% lower in cost than any other binder on the market!

BEST SERVICE Carver has the in-the-foundry experience and know-how to help you use Steinex in your CO_2 operation — successfully and profitably!

JOIN THE HUNDREDS OF FOUNDRIES THAT INSIST ON THE BEST

MAIL TODAY

CARVER FOUNDRY PRODUCTS CO. F-23
Muscatine, Iowa

RUSH information and prices on Steinex binders.

NAME _____ TITLE _____

FOUNDRY _____

CITY _____ STATE _____

CALENDAR of Meetings

Apr. 13-14—Malleable Founders' Society, Market Development Conference, Edgewater Beach Hotel, Chicago.

April 19-20—Magnesium Association, spring technical meeting, Holiday Inn, Montgomery, Ala.

Apr. 21-23—Investment Casting Institute, management conference, Cavalier Hotel, Virginia Beach, Va.

Apr. 25-29—American Welding Society, annual meeting and Welding Show, Biltmore Hotel and Great Western Exhibit Center, Los Angeles.

May 9-12—Instrument Society of America, summer Instrument-Automation Conference & Exhibit, Civic Auditorium and Brooks Hall, San Francisco.

May 9-13—American Foundrymen's Society, 1960 Castings Congress and Exposition, Convention Hall, Philadelphia.

May 9-13—American Society for Metals, Southwestern Metal Exposition & Congress, State Fair Park, Automobile Building, Dallas.

May 11-13—Los Angeles Chapter, American Material Handling Society, Western Regional Materials Handling Show and Packaging Cavalcade, Great Western Exhibit Center, Los Angeles.

May 16-18—British Investment Casters' Technical Association, annual conference, London, England.

May 18-20—Society for Experimental Stress Analysis, spring meeting, Hotel Severin, Indianapolis.

May 23-31—Magnesium Association, annual meeting, a joint meeting with the Magnesium Industry Council of Great Britain, London and Manchester, England, and Hanover, Germany.

May 23-26—Design Engineering Show, Coliseum, New York.

June 2-3—New York University, vacuum metallurgy conference, University Heights (Bronx) Campus, New York.

June 6-7—Malleable Founders' Society, annual meeting, Elbow Beach Surf Club, Hamilton, Bermuda.

June 6-8—Material Handling Institute Inc., New England Show, Commonwealth Armory, Boston.

June 19-21—Alloy Casting Institute, annual meeting, Homestead, Hot Springs, Va.

June 26-July 1—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

July 4-6—European Investment Casters Conference, Liege, Belgium.

Sept. 6-16—The Machine Tool Exposition—1960, International Amphitheatre, Chicago.

Sept. 6-16 — Production Engineering Show, Navy Pier, Chicago.

Sept. 19-20—Steel Founders' Society, fall meeting, Homestead, Hot Springs, Va.

Sept. 19-24—International Foundry Congress, Zurich, Switzerland.

Sept. 22-23—National Foundry Association, annual meeting, Edgewater Beach Hotel, Chicago.

Oct. 12—Cast Bronze Bearing Institute, annual meeting, Grove Park Inn, Asheville, N. C.

Oct. 12-14—Gray Iron Founders' Society, annual meeting, Netherland Hilton Hotel, Cincinnati.

Oct. 13-15—Non-Ferrous Founders' Society, annual meeting, Grove Park Inn, Asheville, N. C.

Oct. 17-18—Magnesium Association, annual convention, Hotel Carter, Cleveland.

Oct. 17-21—American Society for Metals, National Metal Exposition & Congress, Trade and Convention Center, Philadelphia.

Oct. 17-21—National Safety Council, Annual Safety Congress, Chicago.

Oct. 20-22—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.

Oct. 21-23—Society for Experimental Stress Analysis, annual meeting, Pick Fort Shelby Hotel, Detroit.

Oct. 22-25—Conveyor Equipment Manufacturers Association, annual meeting, Greenbrier, White Sulphur Springs, W. Va.

Nov. 8-10—Material Handling Institute Inc., Central States Show, Kentucky Fair and Exposition Center, Louisville.

Nov. 14-16—Steel Founders' Society, Technical and Operating Conference, Pick Carter Hotel, Cleveland.

Nov. 30 - Dec. 2 — Metallurgical Society of AIME, Electric Steel Conference, Morrison Hotel, Chicago.

Why Foundries are Sold on Carver RAPID MULLER

1 "We are using natural bonded sand in our plant and find the Carver Muller has cut down on bonding material better than 50%. We like the Muller very much."

— S. W. Hastad
West Coast Kings Co.
Troutdale, Oregon

2 "The Carver does a good job for what it was designed. A low priced mixer. Small floor space and does a good job of mixing with CO_2 Sand."

— Nelson Williams, Vice President
Industrial Castings Division
James B. Mathews Co.
Pittsburgh, Pennsylvania

CHECK... COMPARE AND YOU'LL CHOOSE CARVER!

- **The fastest! A batch every 75 seconds!***
- **Only one moving part... no maintenance worries!**
- **Absolutely no lumps or wet spots!**
- **Easiest to clean! Just reach inside!**
- **3 times lower initial investment than with most mullers!**
- **Works equally well with any kind of binder!**

*Applies to CO_2 Sand. Oil sand may take up to three minutes.

Only Carver Has Everything For the CO_2 Process!

CARVER V & S Core Shooters

CARVER Automatic Gassing Apparatus

KRAUSS Taper Slot Core Vents

STEINEX available only from CARVER

MAIL COUPON TODAY

F-3

CARVER FOUNDRY PRODUCTS CO.
Muscatine, Iowa

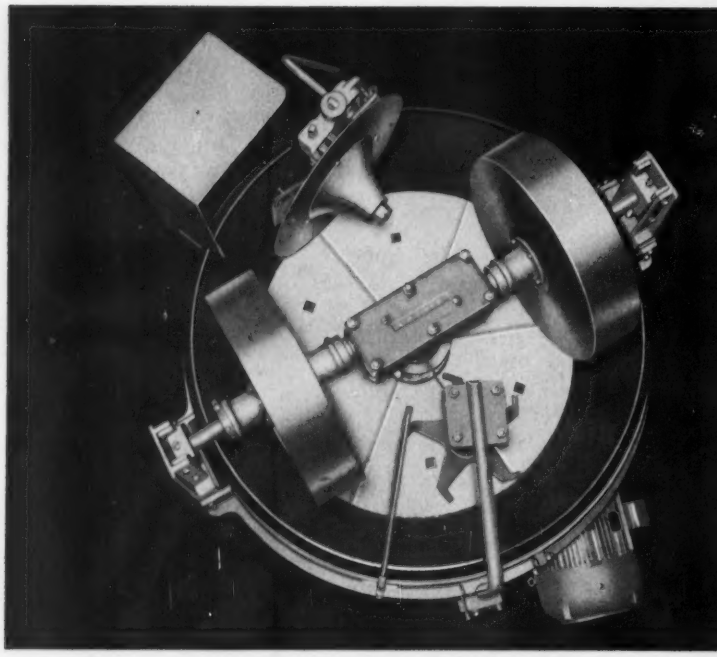
I want to compare! Tell me more about Carver Rapid Muller.

NAME _____ TITLE _____

FOUNDRY _____

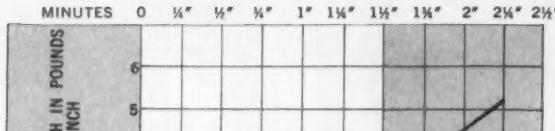
CITY _____ STATE _____

Circle 566 on Page 53



Muller Mixing Increases Sand Strength Greatly . . . Rapidly!

Sand Strength Curve Proves the Difference



This Strength Curve Chart demonstrates how much more effective muller mixing of sand is over regular scraper type mixing. In this test a Clearfield mixer was used to mix a charge of 91% burned sand, 3% bond and 6% water. At the start of the run the mulling wheels were removed completely . . . the batch was charged and the mixing operation continued for 1½ minutes with only the disc and agitator operating on the material. *There was only a slight increase in the strength of the sand.* Then the mullers were set into the machine and operation on the same batch continued for 1¼ minutes. During this very short period with the mullers operating, *the sand strength increased very rapidly.* You can speed production, with assured quality results—and cut costs too—with a Clearfield muller-type mixer. *Let us prove the superiority of Clearfield Muller-type Mixers with a sample run of your own batch. Just call us.*

WITH its speed, dependability and special mixing features, a Clearfield Mixer prepares your sand properly and exactly as you want it . . . thus paying for itself many times over. In addition to the strength-building mullers, Clearfield Mixers have other features that assure quality results every time. First, all Clearfield Mixers work on the rotating pan principle so that every particle in the batch is kept in continuous motion, with the ingredients alternately spread and gathered together to maintain highest mixing efficiency.

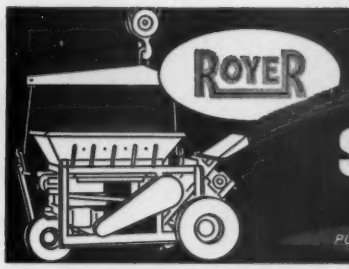
Another feature is the patented star-shaped agitator which covers the entire flat surface of the revolving bottom and prevents material from forming hard cakes or lumps. The agitator is driven automatically by the force of the sand being rotated by the pan motion; a "whirlpool" action is created, speeding up the mixing process and promoting clean emptying of the pan.

The Clearfield double-duty disc, also patented, cuts all the material free from the revolving pan rim at each revolution, turns it over and diverts a continuous roll of material under the mullers. (Moved to the discharge position, this disc unloads the complete batch in 15 to 20 seconds!)

You get thorough, proper blending and mixing when you use a Clearfield Mixer.

See the Clearfield Mixer in Action in booth 1002 at the AFS Foundry Show Convention Hall, Philadelphia, Pa. May 9-13

CLEARFIELD
MACHINE COMPANY
CLEARFIELD, PENNSYLVANIA, U.S.A.



SAND CONDITIONING TOPICS

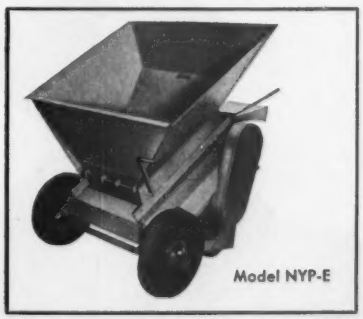
PUBLISHED BY ROYER, MANUFACTURERS OF THE FOREMOST IN SAND CONDITIONING EQUIPMENT

AERATE AND FLUFF AT MOLDING STATION FOR MAXIMUM BENEFITS

To take full advantage of the economies of central sand conditioning, highly mechanized foundries usually find it necessary to sacrifice other elements. Some of these are permeability, flowability and cooled sand.

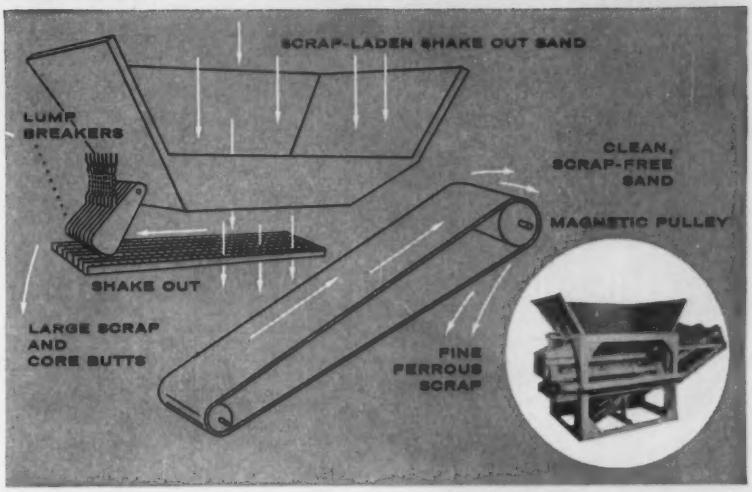
To produce the best possible molds, sand should be aerated and fluffed as the final operation before it is used. More and more, foundries with central systems are turning to Royer to help improve their sand's properties.

Thousands of foundries have increased the permeability of their molding sand 10 to 20 points by aerating at the molding station with a Royer Separator and Blender, like the Model NYP-E shown here. Besides eliminating the problems of packed sand, they gain the advantages of better flowability and cooled sand. Royerizing reduces new sand requirements and often eliminates entirely the need for facing sand. Castings have smoother finishes, too, reducing grinding and cleaning costs.



Royer Sand Separators and Blenders are available in sizes to fit any foundry need. This Model NYP-E handles the charge of a front-end loader. Other models are available with capacities as low as seven tons per hour.

Two bulletins describe the Royer line of Sand Separators and Blenders. Bulletin SS-54 covers machines from 7 to 60 tons per hour maximum capacities. Bulletin NY-54 describes the series engineered for high capacity sand handling systems. Write for your copy today.



Sand Contamination Drains Your Profits

Periodic business recessions in the foundry industry point up the need to eliminate waste and excessive hand labor—or sacrifice profits. In one area of foundry operation—sand contamination — important strides have been made in stopping the profit drainage.

Tramp iron damage usually occurs at the muller, conveyor belts, aerator or patterns. Patterns faced with contaminated sand produce poor casting finishes and high scrap loss. Probably the most efficient and economical way to remove contamination and produce clean sand is with a Royer Scrap Control Unit.

Referring to the drawing, shake out sand from the molding floor is dumped by front-end loader into the receiving hopper. Large scrap is riddled out by the Shake-Out and discharged at convenient wheelbarrow height for collection and removal.

Ferrous scrap small enough to pass through the grid openings of the Shake-Out is separated from the sand by a magnetic pulley at the upper end of the conveyor belt. Depending upon the degree of mechanization you employ, clean sand discharge may be made to a skip hoist feeding a muller, conveyor belt, or into the hopper of a Stationary Royer Separator and Blender for cooling, aeration and blending. We recommend discharge onto a heap for transporting by front-end loader to a Portable Royer Separator and Blender at the molding station for cooling, aerating and fluffing.

If tramp iron is the cause of any of your profit loss, we invite you to discuss your problem with the foundry-wise Royer agent serving your territory. He'll explain how a Royer Scrap Control Unit can pay for itself in less than two years, stop your profit drainage and improve the quality of your castings.

Your first step in stopping profit drainage caused by sand contamination is to send for our latest Scrap Control Bulletin. Write, wire or phone . . . ROYER FOUNDRY & MACHINE CO., 159 Pringle Street, Kingston, Pa.

WE INVITE YOU TO VISIT US AT BOOTHS 1001, 1002, 1102 AT THE FOUNDRY SHOW. IN AN UNUSUAL FULL SCALE WORKING EXHIBIT, THE ROYER EQUIPMENT DESCRIBED HERE WILL BE OPERATED IN CONJUNCTION WITH THE CLEARFIELD MIXER DESCRIBED ON THE OPPOSITE PAGE.

Circle 568 on Page 53

Preston Carter and a mountain of confidence

R. Preston Carter is a typical Alcoa salesman. Our picture shows him leaning on a stack of aluminum pig, confident that he will always be able to depend upon Alcoa to meet his customers' pig and ingot needs.

We've called the stack of pig a "mountain" because that's the impression we always get when we walk among such stacks at any of Alcoa's many producing locations, where "mountains" like this are constantly being built and torn down again for shipment. And, as "Pres" will tell you, Alcoa, the world's largest producer of primary aluminum, has more smelting facilities under construction than any other basic producer.

A 25-year veteran with Alcoa, Pres knows his company shares his faith in the market for primary aluminum and is keeping pace with the requirements of an expanding economy.

Pres' knowledge of the light-metal foundry and extrusion industries is as much a part of him as his mustache. He's watched them grow, fostered their ambitions. As a metallurgist with experience in several of Alcoa's plants, he has confidence in his product and is convinced that Alcoa's quality control leads that of all the other smelters. Pres knows Alcoa will always back him up with a better product and more of it, better delivery and more experienced technical assistance than his competitors can provide.

As a continuing source for aluminum pig and ingot, Alcoa, the company with more faith in the market, is your soundest choice. Just call your local Alcoa sales office (you'll find it under "Aluminum" in the Yellow Pages of your telephone directory).

SEND FOR ALCOA'S NEW PIG AND INGOT BROCHURE

This new 12-page booklet lists all grades and alloys available in pig, ingot and billet form, together with their composition and properties. It also describes the services and technical assistance available from Alcoa's metallurgical staff, the most experienced and unbiased in the industry. Write today: Aluminum Company of America, 2115-D Alcoa Building, Pittsburgh 19, Pa.

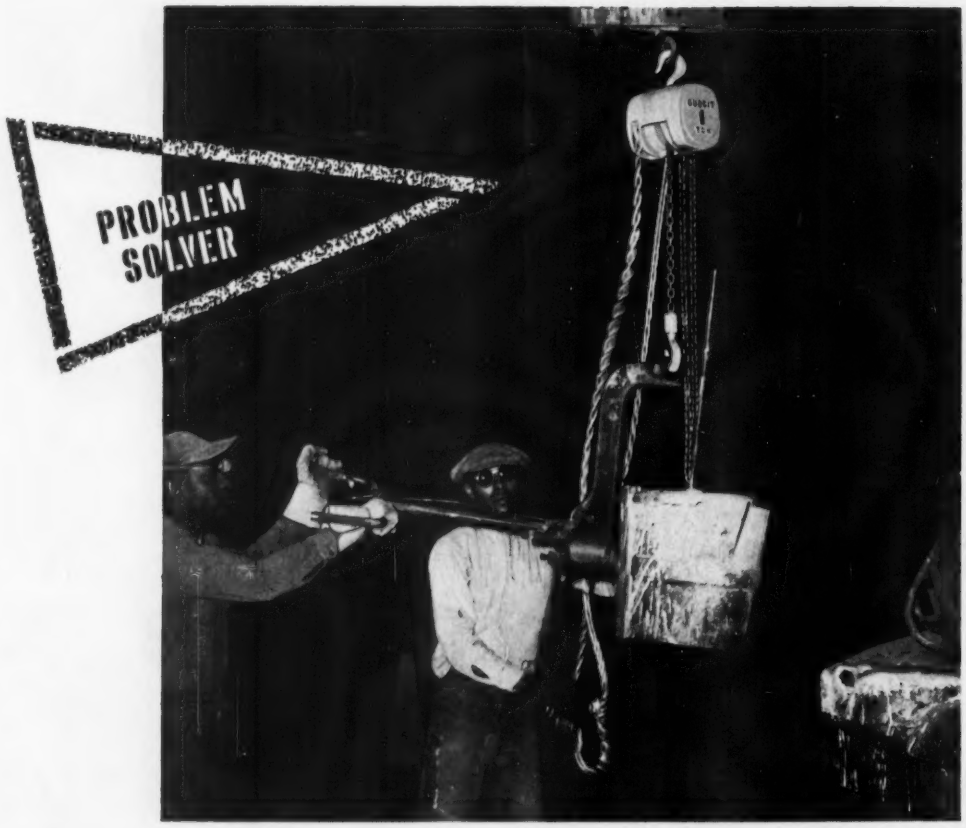
For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and the Emmy Award winning "Alcoa Theatre" alternate Mondays, NBC-TV

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

YOUR GUIDE TO THE BEST IN ALUMINUM VALUE

Circle 569 on Page 53



Pouring efficiency boosted with Budgit® Chain Block

Budgit Aluminum Army Type Chain Block. Integral push and hand-geared trolleys are adjustable to fit I-beams in a number of sizes. Low head-room design. Capacities: ¼ to 10 tons.

Budgit Aluminum Chain Block. Light in weight but tough. Can be carried to the job, hung up and operated by one man. Spark and corrosion resistant models. Capacities: ¼ to 2 tons. Hi-Cap models from 3 to 10 tons.

Tugit Lever-Operated Hoist. Light, compact, portable. Easy to operate even in close quarters at any angle. Fine for maintenance. Capacities: ¾ to 3 tons.

Budgit Differential Hoist. Low-priced lifting tool for occasional use where high efficiency isn't essential. Light and compact. Capacities: ¼, ½ and 1 ton.

60 C-2

Foundry dirt and grit can raise havoc with hoisting equipment. That is why this producer of small castings invested in a 1-ton Budgit Aluminum Chain Block for ladle pouring. The external load brake on the old-style hoist formerly used collected dirt and grit, then locked-up, causing pouring delays. Muscle straining hand chain pull added to the tough work on every lift.

The sealed-in mechanism on the Budgit Chain Block eliminated load brake maintenance and work stoppage. Efficient equa-torque gearing eases hand chain pull so much, hoisting operations take little effort, and control is so accurate the ladle can be quickly inched into position.

In foundries, areas where the air is dense with dirt and grit, and ambient temperatures run high, the use of Budgit Chain Blocks provides the most desirable performance without costly maintenance problems. For complete information about these modern hoists, call your nearby Shaw-Box Distributor or write for Bulletin 16010-12A.

BUDGIT CHAIN BLOCKS

A product of

MANNING, MAXWELL & MOORE, INC.

Shaw-Box Crane & Hoist Division • Muskegon, Michigan
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

MAXWELL MANNING & MOORE INC. M&M TRADE MARK

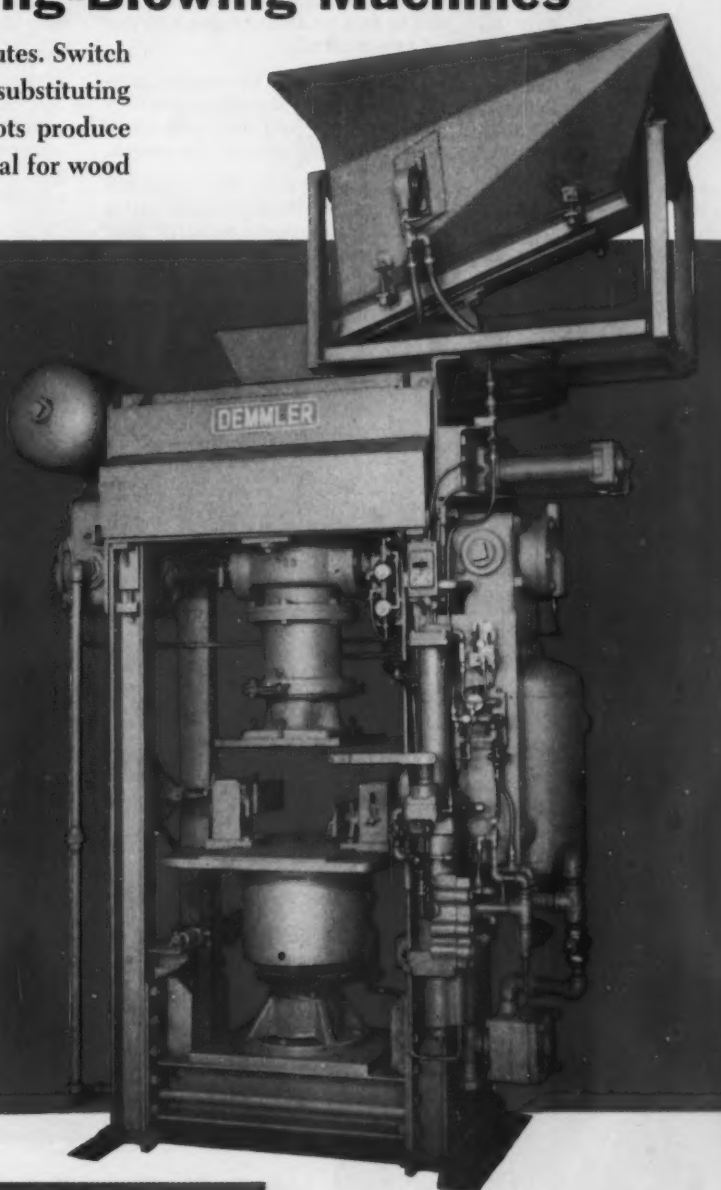
DEMMLER

Gives You Better Cores At Less Cost

SERIES 100

Core Shooting-Blowing Machines

Change from one job to another in minutes. Switch from shooting to blowing quickly by substituting blow plate for shoot plate. Multiple slots produce minimum blast and abrasion effects. Ideal for wood core boxes.



These DEMMLER features help eliminate down- time on job changes:

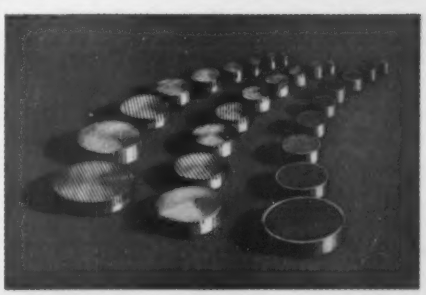
1) Universal slotted shoot plate with adjustable slots. No additional shoot plates required.
2) Slotted sleeve-type magazines eliminate sand cratering.
3) Automatic Cycle Controls put machine through a complete cycle of operations with a single movement of the valve lever.
4) Ten inch, push-button operated table height adjustment eliminates manual operation.
5) Automatic Vibratory Sand Feeder keeps sand flowing smoothly, evenly.
6) Stationary sand magazines for accurate 10" draw stroke, independent of table-height adjustment.
7) Two air reservoirs and two ultra-high speed, large capacity blow valves for top-quality cores.
8) All wearing parts are readily accessible for ease of maintenance. Low maintenance costs.
9) Series 100 machines are available in six sizes to meet all production requirements – from faucet cores (ounces) to boiler section cores (300 lbs.).

PRECISION CORE BOX VENTS

Demmler is by-far your best source for precision core box vents, manufactured by specialists who pioneered in the core blower industry. Many sizes, slot widths and screen meshes are available in brass and steel core box vents.

NEW HL 150 MESH VENTS:

New general purpose vent which practically eliminates the cleaning coarser screens demand. Write for literature.



DEMMLER MANUFACTURING COMPANY
Kewanee, Illinois

Manufacturers of quality core producing equipment for over 50 years

Circle 571 on Page 53

How Lloyd Price increased

Removing the flash from some castings is no job for ordinary grinding wheels. Often the material is so sharp and hard that it gouges the surface of the average wheel like a wolf chewing chicken bones. At the Albert Lea Foundry, Albert Lea, Minnesota, the longest-lasting wheels they had ever been able to find for this purpose had had a useful life of two months.

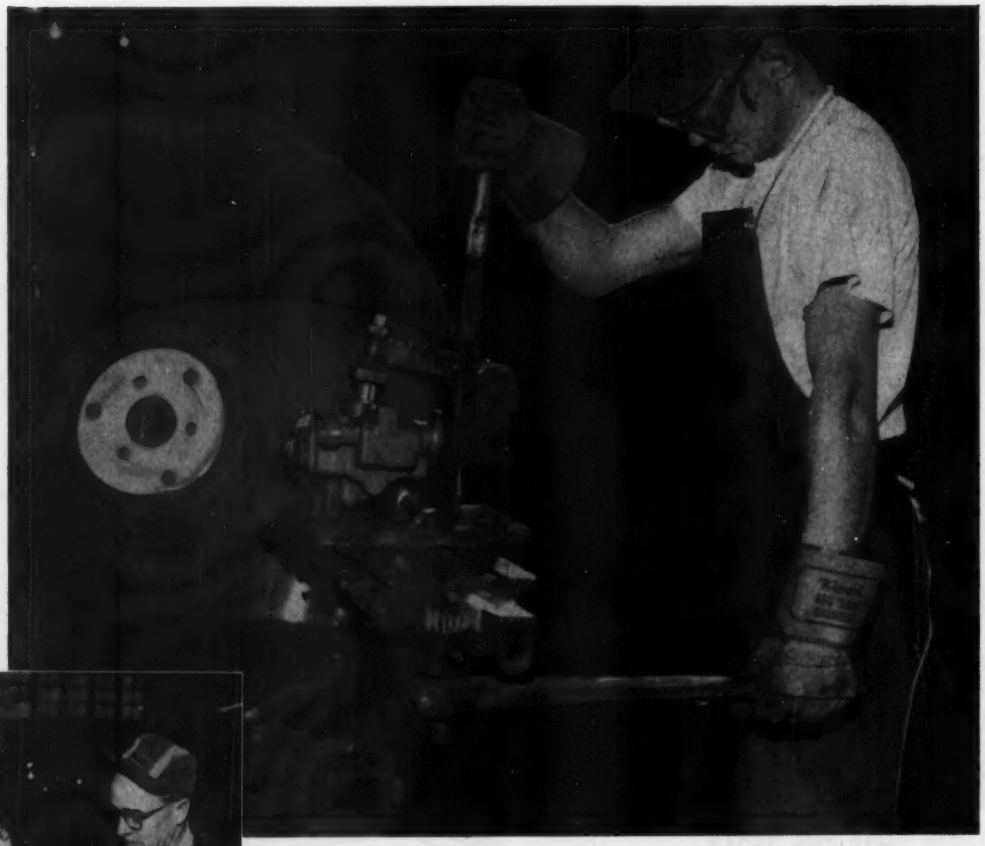
But the Albert Lea Foundry is the biggest independent outfit of its kind in Minnesota and they frequently have long-run jobs that add up to big tonnage. So they didn't give up the search.

Lloyd Price, Bay State Abrasive Specialist, was called in and he figured he could probably better the two-month life of his closest competitor. But even Price never forecasted the results he got.

Working with Bay State engineers in Westboro, he came up with a 30" resinoid bond wheel that finished no less than 207,176 individual castings over a ten-month period. The castings weighed a total of 1,771,355 lbs. This record performance was actually *five times better* than that of any previous wheel.

While this was a special case, it's surprising how often Bay State distributors and Abrasive Specialists are able to improve grinding wheel performance and cut costs even in apparently routine grinding operations. Why not see what your own Bay State distributor or direct representative can do to help *you?*

Better Grinding at lower cost . . . that is his business.



Operator Donald Wente grinds flash off casting with 30" Bay State resinoid bond wheel that finished more than two hundred thousand similar castings in a record-breaking useful life of ten months.

Cleaning Room Foreman Martin Bridley and Maintenance Foreman Clarence Bailey examine ground surfaces of intricate casting designed for major home appliance.

grinding wheel life 500% at Albert Lea Foundry

With a B.A. degree in Commerce, Bay State's Lloyd M. Price knows that a dollar cut out of costs is usually an extra dollar of pure profit. If he didn't learn it in college, he has certainly learned it from his years of practical experience, first, with Morse Twist Drill & Machine Co., and, now, with Bay State. As he says: "Cutting costs is just about the most important part of our business."

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Pittsburgh, Los Angeles. *Distributors:* All principal cities.

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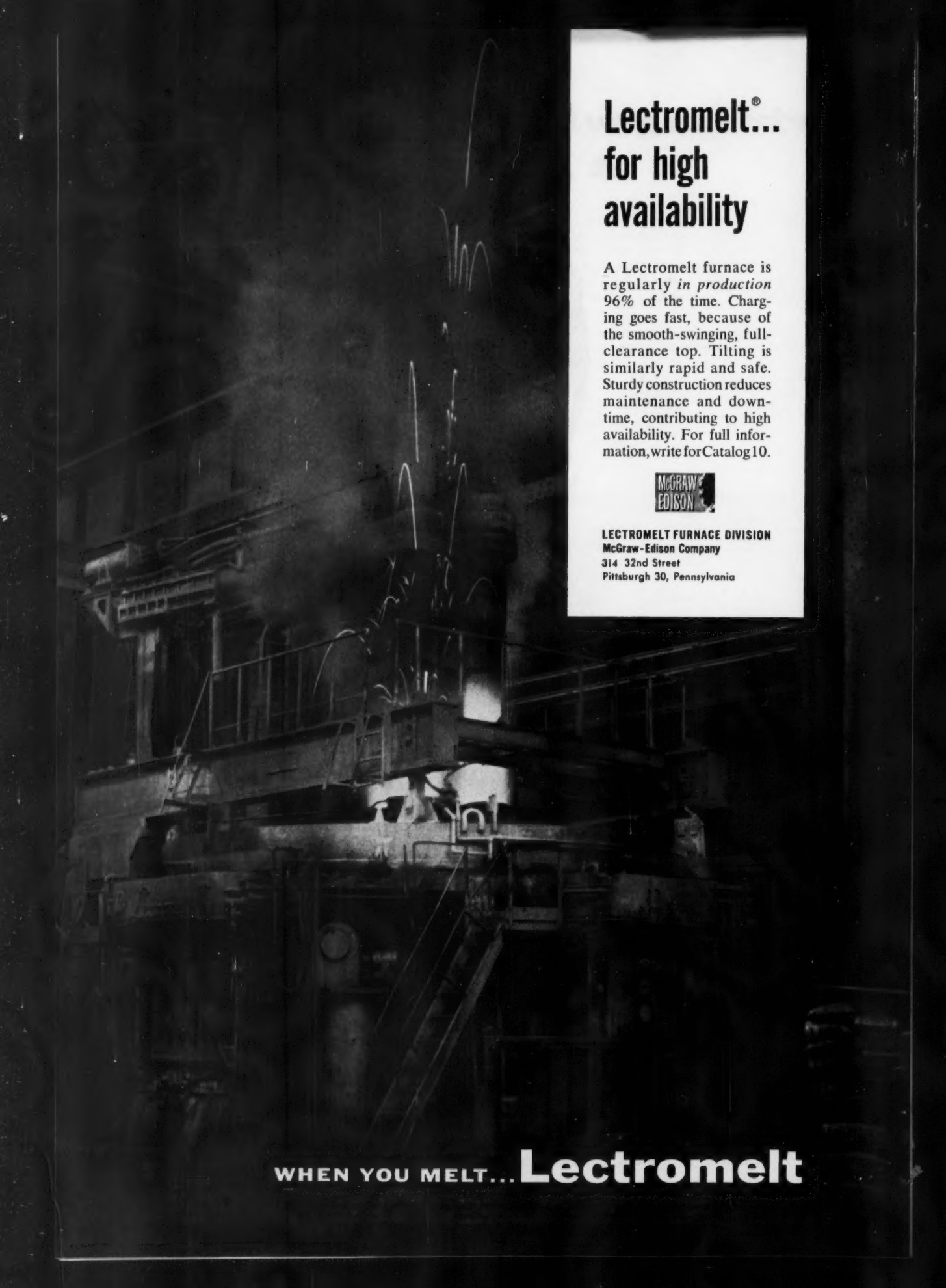

Lectromelt®... for high availability

A Lectromelt furnace is regularly *in production* 96% of the time. Charging goes fast, because of the smooth-swinging, full-clearance top. Tilting is similarly rapid and safe. Sturdy construction reduces maintenance and downtime, contributing to high availability. For full information, write for Catalog 10.

McGRAW EDISON

LECTROMELT FURNACE DIVISION
McGraw-Edison Company
314 32nd Street
Pittsburgh 30, Pennsylvania

WHEN YOU MELT... Lectromelt

every drop must be

EXACTLY ALIKE

Consistent product uniformity is an enforced rule of procedure at THIEM — a company attitude. Every shipping drum is carefully checked with a depth light for dryness, freedom from scale, rust and alkalinity before it is filled with a Thiem product. Thus, you are doubly assured a Thiem core coating, oil, or thinner you use today will be just like the one you used yesterday and a year ago.

THIEM DISTRIBUTORS

Brumley-Donaldson Company
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Combined Supply & Equip. Co., Inc.
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Manufacturers Equip. & Supply Co.
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Fire Brick Supply Co.
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Western Foundry Sand Co.
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Kramer Industrial Supply, Inc.
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Everitt H. Lueders
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Pearson & Smith
Spokane, Washington

Brandt Equip. & Supply
Co., Houston, Texas

Don Barnes Limited
Hamilton, Ontario, Canada

James Crain, Caseyville, Illinois

THIEM PRODUCTS INC.

MILWAUKEE 19, WISCONSIN

Manufacturers of foundry products exclusively

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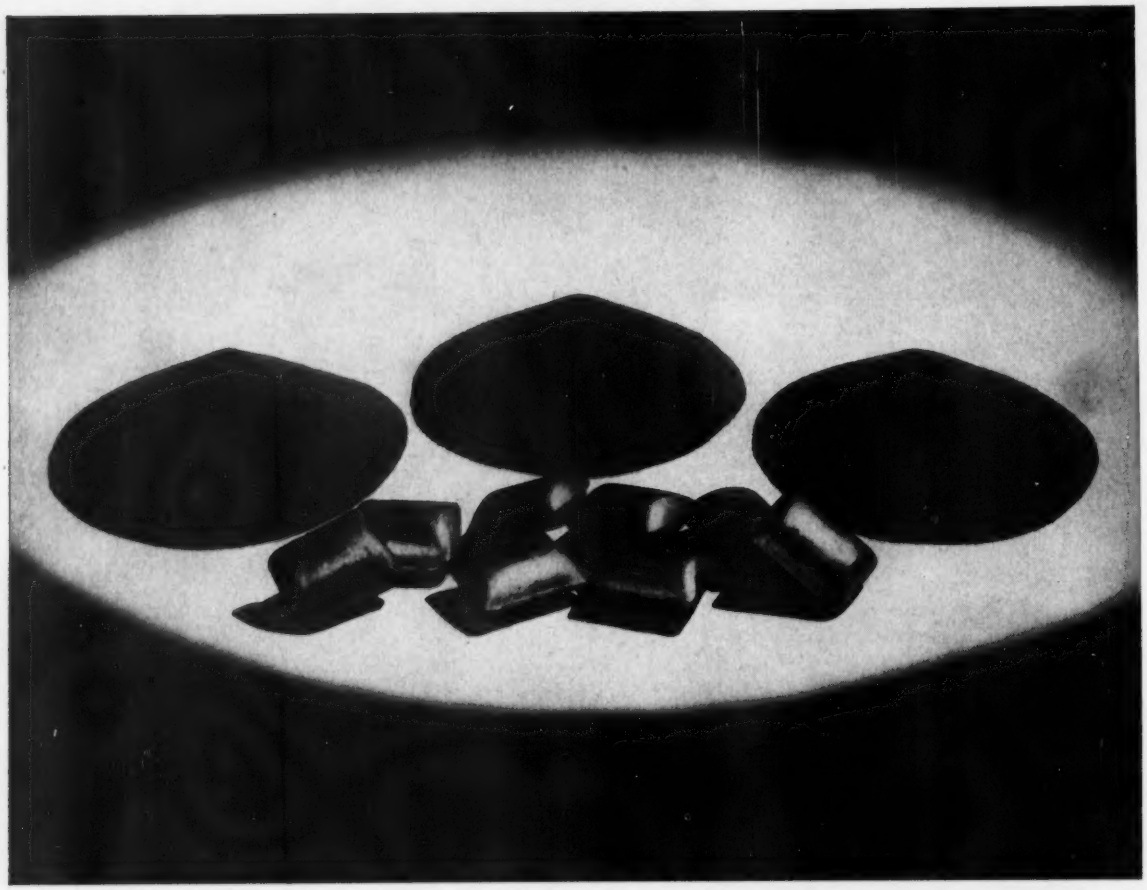


Sherritt High-Purity Nickel is available in handy briquettes (1¼" x 1½" x ⅝") and in three grades of powder—Grade C (coarse), Grade F (fine), and Grade S (medium).

nickel as you like it

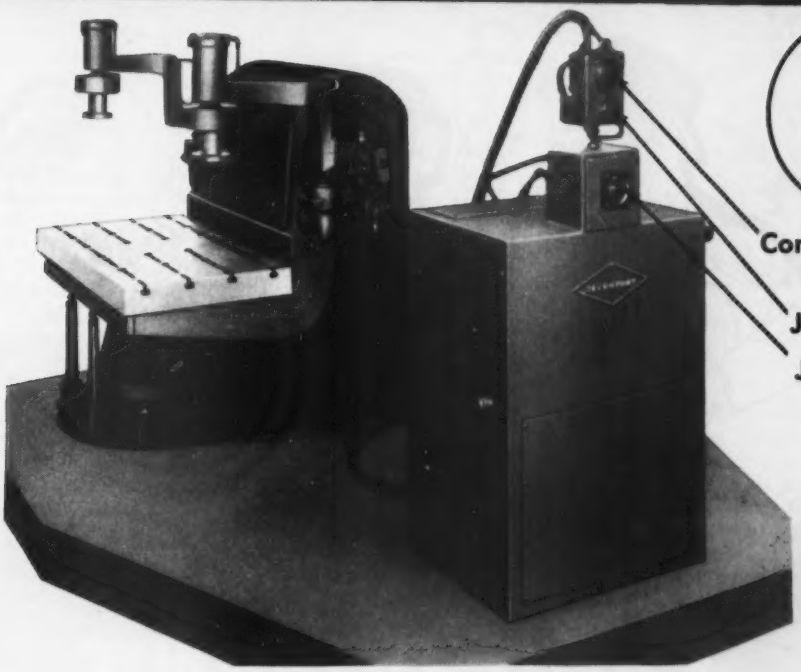
Nickel as you like it . . . *in purity, in handling ease, and in alloying efficiencies.* Sherritt's unique hydrometallurgical refining process yields nickel powders with a guaranteed purity of better than 99.8%. Available in briquettes and in three grades of powder, Sherritt nickel takes all prizes for handling ease. There are no strips to cut, no unwieldy plates to handle. Alloying is quicker and less troublesome. By disintegrating into smaller agglomerates, Sherritt powders and briquettes go into solution more rapidly with less chilling. This low-chilling property permits alloying additions even at the end of the heat. Sherritt also offers special grades and coated powders.

SHERRITT

FOOTE MINERAL COMPANY is the exclusive sales agent for Sherritt nickel and cobalt in the United States and Canada. For product literature, prices, and delivery information, contact the Foote Mineral Company, 4738 Eighteen West Chelten Building, Philadelphia 44, Pa.

SHERRITT GORDON MINES LIMITED

The First COMPLETELY AUTOMATIC, Fully Air Operated JOLT-ROLL-OVER DRAW Molding



RESEARCHED and TESTED

This new "DAVENPORT" automatic Roll-Over makes a molder out of a laborer in a short time. Built to take a beating. Practically dust-proof. Dehydrates air used. Self oiling.

INCREASES PRODUCTION up to 50%

Available in 3 sizes — 1000, 1500, 2500 lbs. capacity

SEQUENCE OF OPERATIONS

1. JOLTS
2. ARMS SWING IN
3. CLAMPS FLASK
4. ROLLS OVER
5. RAISES AND LEVELS DRAW CYLINDER
6. VIBRATOR OPERATES
7. UNLOCKS FLASK CLAMPS AND SWINGS OUT
8. DRAW TABLE LOWERS
9. ROLL OVER RETURNS TO NEUTRAL POSITION

DAVENPORT MACHINE AND Foundry Company
DAVENPORT IOWA

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International Minerals & Chemicals

A REPORT TO FOUNDRIES

FROM TOM BARLOW

you gotta put something extra in the pot

Ever watch a good cook in operation — or do you prefer to be surprised? You haven't lived until you squat up on the kitchen stool and watch an artist at work. Next time the can opener is broken, drag out a recipe book and have a ball. The first thing you'll find is that the meat and potatoes are just the beginning. More than half the ingredients are the "extra" things which go in the pot to make the difference between eating and just taking on a load of food.

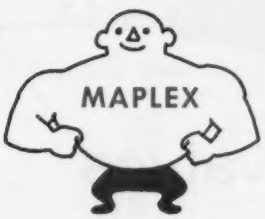
Now we don't advocate mixing foundry sand in a stew pot, but we have found that the foundries who make the most salable castings put a lot of thought into that extra ingredient which makes the mix suit the work it was meant to do. Foundry sands can use their "salt and pepper," too — if it's done right. In sand, the extra is the additive and, as in cooking, it should be done right, or, instead of a masterpiece, it's a mess. Chocolate sauce may be good on ice cream or cake, but I can't stand it on steak. There is a time and place for everything, as the woman said as she kissed her cow.

The first additive, if you want to call it that, was introduced to revive worn-out natural sand — hence the name REVIVO. Since then, the picture has become more complex — and better. (Wonder what it was like to get a good home-cooked meal

before Marco Polo went east and brought back a load of spices. Sure must have been flat.) Back on the subject of sand — the benefits of more ingredients, such as Black Hills and Dixie, began to pile up. Lower moisture, better toughness, better finish, more control, closer tolerances, etc. With a full line of bond clay under its belt, ECP next introduced the Age of Additives.

Further developments came fast. High-Pressure Molding, PLASTI-BOND, TRIPLACT and Z-FLO filled out the framework. Today these products are hard-working tools that help the foundryman produce castings that measure up to the tighter, harder-to-meet specifications he gets from his customers. When you get right down to it, Eastern Clay Products is helping the foundryman's sales force as much as the men in the shop.

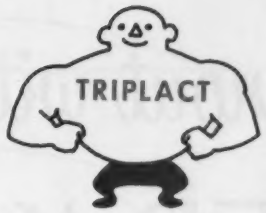
But let's get down to the additives themselves. Why so many? Wouldn't one additive improve overall sand quality and justify its existence? Sure, but let's go back to the art of cooking for a minute. To brighten the flavor, our cook adds sugar for sweetness, vinegar for a sour "bite," and Accent® to make the flavor sing. She depends heavily on additives to achieve the desired



Pure hard maple flour that provides 100% increase in hot strength at 2000 F and highest amount of reducing or cleaning action gas.

end result — and thank heaven she doesn't use the same additive for everything!

TRIPLACT, for instance, has a triple action. (1) It increases flowability,



Additive to core and molding sand; reduces scabbing, stops veins and fins in cores, improves finish, imparts higher flowability.

makes molds and cores harder, denser. (2) It provides a strong reducing atmosphere that helps stop burn-in and penetration. (3) It controls both expansion and collapsibility without causing lumpy shakeout or pitch balls.

PLASTI-BOND, on the other hand, retains flowability, permits lower moisture content, and increases sand toughness and strength at the same time. Sound amazing? Well it is; PLASTI-BOND is an amazing additive. It was developed to meet

The only way to combine toughness, flowability, strength and low moisture in a fine sand. Developed for high-pressure molding, but has wide application.

the demands of high-pressure molding and to produce "precision" castings in green sand. But PLASTI-BOND is not confined to high-pressure molding alone. The same properties find applications in every casting operation requiring improved finish, better weight control, extended versatility, fast, economical cleaning and absence of casting defects.

MAPLEX is a pure, unadulterated hard sugar maple wood flour. It works well with PLASTI-BOND — better than any other wood flour we

Newest of the additives. Highly durable; reduces cuts and washes, deep pockets, broken molds. Offers high dry strength and toughness, with maximum flowability.

know — in arriving at just the right balance of molding properties for a given job. A good muller man can take these two additives and "feel" his way — just like a good cook — and give you a sand as tough and gummy, or as smooth and soft, as you want it. To increase toughness, increase the PLASTI-BOND. If it's too tough, add MAPLEX. Increase the MAPLEX to improve shakeout and flowability.

Z-FLO, in addition to toughness, offers good dry strength. In fact, it is often substituted for pitch — but with improved flowability. It's the latest addition to ECP's full line of additives . . . qualifies as a member of the family because of its durable, easy-to-mull properties.

Add it all up. Additives can give foundry sand more versatile properties than most people realize. There's a right additive for what you do. And we have a wide enough range of products *and* know-how to make our recommendations both impartial and accurate. We can select a product to fit your job, rather than look for a job to fit the product.

IMC Products for Growth*

*Trademark

EASTERN CLAY PRODUCTS DEPT.

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

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17-60

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No coil burnout with SPEED KING®

...pilot operated control valves

• Built to JIC standards • interchangeable pilots • choice of mounting types, optional features • ac or dc, any voltage • ¼ to 1 in. NPT

SPEED KING solenoid pilot coils, potted in molded resin, are unconditionally guaranteed against coil burnout for the life of the valve! And, Speed King pilots are totally enclosed, and sealed against entrance of dirt or moisture . . . valves are fully air-operated for speed and dependability . . . feature a hard-chrome plated stainless steel plunger floating in O-rings, to eliminate wear-producing metal-to-metal contact.

For multi-million cycle dependability, specify Valvair® SPEED KING control valves.

Write for free Bulletin SK-100. Address: Valvair Corp., Akron 9, Ohio, Dept. FO-460

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Bellows-Valvair

Other INDUSTRIAL DIVISIONS of IBEC: The Sinclair-Collins Valve Co. The Bellows Co., Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio.

8111

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Late News

RECOVERY: Malleable and steel foundries made the sharpest recovery in castings production last year, final figures of the Department of Commerce show. Total shipments of castings in 1959 were 15.8 million tons, 20 per cent ahead of 1958. Increases by types of foundries were: Malleable 35 per cent, steel 26 per cent, aluminum 22 per cent, gray iron 19 per cent, brass and bronze 18 per cent, magnesium 17 per cent, and zinc 11 per cent.

FEF OFFICERS: R. B. Parker, assistant to the president, American Brake Shoe Co., was elected president of the Foundry Educational Foundation at its annual meeting, March 16. He succeeds Frank G. Steinebach, editor, *Foundry*. D. H. Morgan, director of college relations, Dow Chemical Co., was named vice president; Anton Dorfmueller Jr., Archer-Daniels-Midland Co., secretary, and E. M. Knapp, Ferro Machine & Foundry Inc., treasurer.

PIPE PLANT OPENS: Griffin Wheel Co., subsidiary of American Steel Foundries, Chicago, has converted production of its Council Bluffs, Iowa, plant from iron freight car wheels to cast iron pressure pipe. Conversion to a pipe-producing facility began in April, 1959, and was completed March 25. The plant, consisting of 95,000 sq ft of buildings on 19 acres of land, is in full production. Griffin pipe will be cast in 20-ft lengths by the Delavaud process.

FOUNDRY SOLD: Racine Foundry & Mfg. Co., Detroit, has purchased the assets of Enterprise Foundry Co., of the same city. Both plants will cast brass, bronze, copper, alumi-

Foundry Statistics

Iron and Steel Scrap Consumption

(Gross tons*)

	All Scrap Total	By Types of Furnace — Cupola Total	Air Total	Electric Total
1957	65,688,592	9,220,405	1,026,951	8,876,400
1958				
Nov.	4,803,615	700,704	74,382	691,078
11 mo.	45,269,076	6,963,478	740,795	6,439,947
Dec.	4,973,670	761,494	80,593	712,779
Total	50,242,746	7,725,970	821,388	7,152,726
1959				
Jan.	5,375,042	783,045	86,519	767,289
Feb.	5,657,873	791,137	88,326	801,692
Mar.	6,677,499	873,982	101,956	965,048
Apr.	6,644,905	911,313	106,972	996,126
May	6,642,572	868,661	99,256	1,029,573
June	6,322,404	885,497	104,683	997,921
July	3,584,931	750,208	87,441	603,726
Aug.	1,875,165	691,786	81,184	374,678
Sept.	2,114,015	801,588	99,090	441,134
Oct.	2,266,709	798,569	98,279	445,137
Nov.	4,796,896	814,233	82,784	801,555
11 mo.	51,976,011	8,770,019	1,056,520	8,223,879

Index of Foundry Equipment Orders

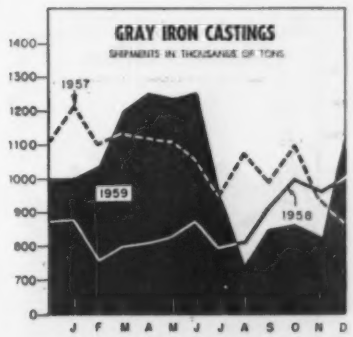
Foundry Trades Only

(Net Orders Closed, New Equipment)

	1959	1960
Jan.	127.4	95.5
Feb.	237.1	....
Mar.	166.6	....
Apr.	154.2	....
May	157.0	....
June	125.1	....
July	110.7	....
Aug.	134.1	....
Sept.	131.3	....
Oct.	140.8	....
Nov.	131.2	....
Dec.	95.9	....

Note: Base period 1947-49 taken as 100 per cent monthly average.

Source: Foundry Equipment Manufacturers Association.



GRAY IRON CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings — Total	All Castings — For Sale	Miscellaneous Castings Total	Miscellaneous Castings For Sale	Nodular Iron Castings Total	Heavy Steel Ingot Molds Total	Chilled Railroad Car Wheels Total	Pressure Pipe & Fittings Total[2]	Soil Pipe & Fittings Total[2]	Unfilled Orders[3]
1957	12,664,504	6,876,497	7,786,229	3,310,915	.....	2,409,290	359,332	1,351,345	758,308	.....
1958										
Dec.	997,608	509,499	628,720	246,289	13,072	208,942	18,021	85,179	56,746	606,096
Total	10,371,232	5,863,154	6,155,378	2,457,197	117,588	1,884,396	265,114	1,277,685	788,659	.....
1959										
Jan.	1,001,771	517,390	625,604	250,161	12,061	214,985	27,650	75,571	58,056	687,245
Feb.	1,036,655	538,514	642,882	252,115	12,619	230,706	31,035	76,147	55,885	767,360
Mar.	1,205,572	666,034	701,527	286,692	13,881	270,293	35,820	108,131	89,801	846,937
Apr.	1,245,702	688,755	726,105	295,982	14,663	270,476	35,655	129,861	83,605	892,214
May	1,236,250	685,285	706,073	285,507	16,003	275,563	36,960	141,675	75,979	884,779
June	1,252,016	717,067	707,291	295,064	15,510	268,479	30,723	160,840	84,953	836,707
July	943,486	532,976	602,261	252,907	14,508	107,604	20,486	133,175	79,960	897,536
Aug.	743,564	506,756	485,444	254,232	11,046	13,482	18,479	145,853	80,306	872,993
Sept.	850,043	528,145	595,435	279,357	11,875	19,416	16,272	142,660	76,260	883,278
Oct.	871,779	520,322	622,599	277,927	17,797	20,155	19,647	139,716	69,662	886,970
Nov.	831,504	516,032	493,508	250,342	12,698	165,139	16,723	96,086	60,048	885,368
Dec.	1,110,834	584,516	653,238	271,221	14,651	294,129	20,595	92,139	50,733	845,575
Total	12,329,186	7,001,792	7,561,967	3,251,507	167,312	2,150,427	310,045	1,441,553	865,278	.....

*Source: U. S. Dept. of Interior Bureau of Mines. [1]Source: Bureau of Census. [2]For sale only. [3]All cast iron pipe is shipped for sale.

num, and other nonferrous metals. John C. Emery Jr. is president and general manager of Racine.

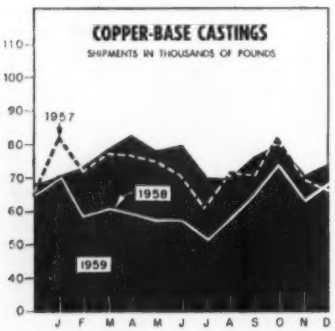
FREIGHT CARS: Orders for new freight cars in February totaled 3411, compared with 7149 in January and 1803 in February, 1959. February deliveries were 5052, and the backlog of cars on order and undelivered on March 1 was 46,323. A year ago, the backlog was only 28,789.

SCRAP STEADIER: Prices of iron and steel scrap have been declining for nearly two months but recently have tended to level off. Last year, prices slid through March, April, and part of May before turning up. Steel scrap grades recently have been selling at levels about $5 a ton lower than a year ago, and cast iron scrap has been quoted $1 to $4 below last year's market. Supplies of most scrap grades continue ample.

NEW TECHNICAL SOCIETY: The Fluid Power Society is a new technical organization formed to bring together all persons interested or engaged in any activity which may further the development and use of fluid power and to disseminate knowledge pertaining to it or to related subjects. Its formation is a result of collaboration during the last year between the National Fluid Power Association and the Industrial Hydraulics Training Association. Membership is on an individual basis, but the society will carry on its principal activities through local chapters. Executive vice president is Barrett Rogers, and headquarters is at 5595 N. Hollywood Ave., Milwaukee 17, Wis.

PERSONALS: George D. Roberts, formerly executive vice president and treasurer, Turner & Seymour Mfg. Co., Torrington, Conn., has been made president. He succeeds F. H. Griffiths, retired . . . At Albion Malleable Iron Co., Albion, Mich., James W. Hallock was advanced to vice president in charge of sales, Dr. Franklin B. Rote became vice president and technical director, and Arnold A. Behling was named controller . . . New officers of the Hoist Manufacturers Association Inc. are Herbert W. Gledhill Jr., Shepard Niles Crane & Hoist Corp., president, and Fred E. Rau, Yale

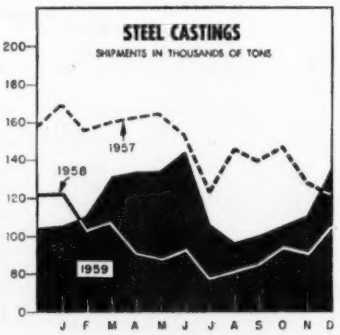
Foundry Statistics



COPPER-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments			
	Total	Sand	Perm. Mold	Unfilled Orders[2]
1957	874,627	789,014	44,789	.....
1958				
Dec.	69,878	63,500	3,105	25,078
Total	762,484	697,360	31,854	.....
1959				
Jan.	70,123	62,266	3,753	25,344
Feb.	72,754	64,558	4,007	26,468
Mar.	78,641	69,472	4,333	29,373
Apr.	82,799	73,567	4,640	29,941
May	78,413	69,351	4,363	27,074
June	79,366	70,512	4,421	30,389
July	69,073	61,650	3,869	31,820
Aug.	68,979	60,346	4,410	32,117
Sept.	75,739	66,211	4,809	29,396
Oct.	79,832	69,583	5,172	28,092
Nov.	70,674	61,490	4,893	29,147
Dec.	73,558	64,579	4,337	29,243
Total	899,951	793,585	53,007	.....



STEEL CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings			Carbon			Alloy			
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Unfilled Orders[2]
1957	1,766,191	1,359,747	349,059	1,328,478	1,019,090	324,951	437,713	340,657	24,108	.....
1958										
Dec.	103,800	81,360	13,187	76,015	59,171	11,934	27,785	22,189	1,253	214,352
Total	1,121,000	856,986	149,644	801,846	606,240	136,251	319,154	250,746	13,393	.....
1959										
Jan.	105,392	82,683	14,408	76,242	59,023	12,948	29,150	23,656	1,460	232,646
Feb.	110,280	86,013	14,686	79,365	61,261	13,316	30,645	24,752	1,370	245,096
Mar.	131,317	103,848	20,086	93,309	75,968	18,410	35,008	27,880	1,676	270,682
Apr.	134,344	104,890	21,372	99,295	76,802	19,761	35,049	28,088	1,611	271,613
May	135,359	105,804	23,825	101,504	78,767	22,498	33,855	27,037	1,327	263,969
June	143,624	111,725	26,567	107,000	82,485	24,568	36,624	29,240	1,999	248,782
July	106,790	83,541	16,007	78,316	60,502	14,520	28,474	23,039	1,487	274,065
Aug.	98,014	79,188	17,607	74,825	60,243	16,373	23,189	18,945	1,234	279,261
Sept.	99,731	79,963	13,975	73,648	58,453	12,830	26,083	21,510	1,145	256,871
Oct.	105,570	84,850	11,819	80,127	63,901	10,978	25,443	20,108	841	288,874
Nov.	109,460	86,026	11,764	77,320	59,294	10,799	29,305	26,732	965	301,858
Dec.	133,346	104,138	18,868	99,643	77,517	17,200	30,770	26,621	1,668	306,346
Total	1,413,227	1,112,669	110,984	1,040,594	814,220	194,201	363,595	297,608	16,783	.....

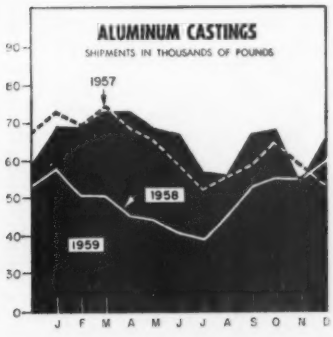
[1]Source: Bureau of the Census. [2]For sale only.

& Towne Mfg. Co., vice president . . . Francis H. Hohn, chief metallurgist, Scullin Steel Co., St. Louis, has been appointed assistant to the works manager . . . Claude J. Neville, formerly executive vice president and treasurer, C. O. Bartlett & Snow Co., Cleveland, has been elected president and general manager. He succeeds H. S. Hersey, who has become board chairman. John R. Hersey has been elected vice president and treasurer . . . Howard F. Lewis has been elected vice president, Greenlee Foundries Inc., Cicero, Ill. . . . James R. Lampman Jr. has been appointed sales representative for eastern foundry sales, Climax Molybdenum Co.

OBITUARY: Victor W. Hain, for 15 years western Michigan sales representative for Frederic B. Stevens Inc., died March 17 . . . Sidney E. McGinty, sales manager, Firegan Sales Co., Chicago, was killed in an airplane crash March 20.

MATERIAL HANDLING: Dollar volume of incoming orders reported in January by manufacturers of material handling equipment was 114.96 on the monthly bookings index of the Material Handling Institute Inc. This index uses the 1954 monthly average as base. January showed an increase of slightly more than 1 point over December. MHI spokesmen are optimistic about prospects for the rest of the year.

MISCELLANY: Ampco Metal Inc., Milwaukee, has bought the A. O. Smith Corp. foundry at Huntington Park, Calif., and will sell its present plant at Burbank, Calif. . . . Z & H Mfg. Corp., Peekskill, N. Y., investment casting foundry, has moved to new and larger quarters at 1000 N. Division St., there . . . Duraloy Co., Scottdale, Pa., has acquired the Walmil Co., Pleasant Ridge, Mich., fabricator of high-alloy fixtures . . . Inductotherm Linemelt Corp., Delanco, N. J., has been formed to manufacture low-frequency induction melting equipment. It is associated with Inductotherm Corp., which makes medium-frequency equipment . . . February new orders for industrial heating equipment of $6½ million were 81 per cent larger than a year ago. Gain for the first two months of 1960 was 63 per cent . . . Primary aluminum production in February was down 5 per cent from January but 10 per cent ahead of last year.



PRODUCTION WORKERS

Estimated Number

	Dec. 1959	Nov. 1959	Avg. 1959
Ferrous	198,400	183,200	191,700
Nonferrous	55,500	54,300	53,300

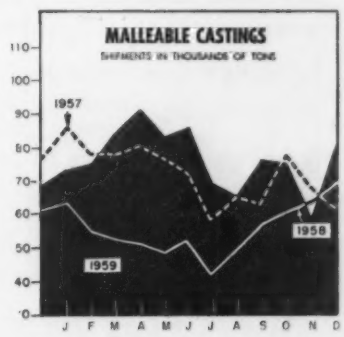
Average Weekly Earnings

Gray Iron	$99.47	$93.45	$96.24
Malleable Iron	98.66	94.64	95.44
Steel	99.33	95.50	101.35
Nonferrous	102.51	100.61	99.87

Average Weekly Hours

Gray Iron	40.6	39.1	40.1
Malleable Iron	40.6	39.6	40.1
Steel	38.5	37.6	39.9
Nonferrous	41.5	40.9	41.1

Source: Bureau of Labor Statistics.



ALUMINUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments				Unfilled Orders[2]
	Total	Sand	Perm. Mold	Die	
1957	751,818	143,991	232,326	373,586	.....
1958					
Dec.	64,178	11,726	22,948	29,363	78,732
Total	641,700	125,487	224,092	290,275	.....
1959					
Jan.	68,896	11,238	24,844	32,813	83,314
Feb.	68,351	10,802	25,428	32,147	82,001
Mar.	73,351	12,412	26,964	33,949	82,676
Apr.	72,976	12,700	26,153	33,992	85,636
May	68,268	11,979	25,283	30,877	80,325
June	66,479	12,312	24,927	29,092	81,228
July	56,911	11,581	20,410	24,786	80,450
Aug.	55,904	11,130	17,824	26,818	82,488
Sept.	66,193	12,309	21,506	32,239	81,839
Oct.	67,499	12,958	21,781	32,640	78,930
Nov.	54,557	10,813	16,326	27,303	84,392
Dec.	64,939	12,409	19,902	32,523	84,931
Total	784,344	142,643	271,348	369,179	.....

[1]Source: Bureau of the Census. [2]For sale only.

MALLEABLE IRON CASTINGS

(Shipments of castings—net tons[1])

	Shipments		Standard		Pearlitic		Unfilled Orders[2]
	Total	For Sale	Total	For Sale	Total	For Sale	
1957	862,976	520,118	713,539	431,662	149,437	88,456	.....
1958							
Dec.	68,385	43,041	53,797	32,883	14,588	7,158	65,904
Total	660,650	383,839	540,600	313,597	120,050	70,242	.....
1959							
Jan.	73,186	43,667	56,700	35,139	16,486	8,528	77,322
Feb.	74,760	42,093	57,573	31,976	17,187	10,117	90,291
Mar.	84,335	49,490	67,439	40,515	16,896	9,175	95,822
Apr.	90,974	54,306	75,582	43,835	15,391	10,471	102,506
May	83,472	49,619	66,512	40,438	16,960	9,181	99,879
June	85,497	51,411	68,426	42,453	17,071	8,958	95,339
July	69,184	43,128	55,120	35,787	14,064	7,341	75,252
Aug.	65,062	40,143	53,217	33,224	11,845	6,919	85,852
Sept.	76,063	46,469	60,209	36,619	15,854	9,850	82,274
Oct.	75,511	48,625	61,683	40,088	13,828	8,537	85,031
Nov.	58,258	42,235	48,951	33,981	9,307	8,254	82,565
Dec.	80,060	45,917	61,455	35,891	18,605	10,026	93,874
Total	889,476	557,273	732,868	449,946	186,494	107,357	.....

Prices of Foundry Metals and Coke

(As of March 28, 1960)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE

Connellsville	$18.00-18.50

OVEN

Birmingham	$30.35
Buffalo	32.00
Detroit	32.00
Erie, Pa.	32.00
Indianapolis	31.25
Kearny, N. J.	31.25
Milwaukee	32.00
Neville Island (Pittsburgh)	30.75
New England, deld.	33.55
New Haven, Conn.	31.00
Painesville, O.	32.00
Philadelphia	31.00
St. Louis	33.00
St. Paul	31.25
Swedeland, Pa.	31.00
Terre Haute, Ind.	31.25

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$68.50	$69.00
Birmingham	62.50	66.50
Buffalo	66.50	67.00
Chester, Pa.	Nom.	Nom.
Chicago	66.50	66.50
Cleveland	66.50	66.50
Duluth	66.50	66.50
Erie, Pa.	66.50	66.50
Everett, Mass.	68.00	68.50
Fontana, Calif.	75.50	....
Geneva, Utah	66.50	....
Granite City, Ill.	68.40	68.90
Neville Island (Pittsburgh)	66.50	66.50
Swedeland, Pa.	68.50	69.00
Toledo, O.	66.50	66.50
Troy, N. Y.	68.50	69.00
Youngstown, O.	....	66.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 30.75; tin bronze, No. 225, 41.50; No. 245, 36.00; high-leaded tin bronze, No. 305, 35.25; No. 1 yellow, No. 405, 24.75; manganese bronze, No. 421, 29.25.

ALUMINUM: 99 per cent plus primary ingots 28.10. Secondary No. 12 alloy, 25.00-25.25. Deoxidizing grades: No. 1, 25.50; No. 4, 22.75.

MAGNESIUM: 99.8 per cent notched ingots 36.00, f.o.b. Velasco, Tex. (10,000 lb or more).

COPPER: Electrolytic 33.00, delivered Connecticut valley.

ZINC: High grade 14.25, delivered. Die casting alloy No. 3, 16.50; No. 2, 17.00, delivered.

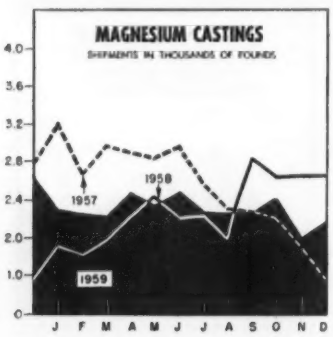
Iron and Steel Scrap

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Clean Auto Cast	Machinery Cast	Malleable	Short Steel Rails
Birmingham	$31.00-32.00	$49.00-50.00	.....	.....	.....	.....	$50.00-51.00
Boston*	**27.00-28.00	**39.00-40.00	.....	.....	**40.00-42.00	.....	.....
Buffalo	31.00-32.00	**45.00-46.00	.....	.....	**49.00-50.00	.....	50.00-51.00
Chicago	32.00-33.00	45.00-46.00	.....	53.00-54.00	53.00-54.00	55.00-56.00	52.00-54.00
Cincinnati*	**31.50-32.50	**43.00-44.00	**37.00-38.00	.....	**54.00-55.00	.....	**55.00-56.00
Cleveland	33.00-34.00	49.00-50.00	35.00-36.00	52.00-53.00	54.00-55.00	52.00-53.00	56.00-58.00
Detroit*	**28.00-29.00	**40.00-41.00	**34.00-35.00	**47.00-48.00	.....	.....	.....
Los Angeles*	34.00	43.00	.....	.....	.....	.....	.....
New York*	31.00-32.00	37.00-38.00	34.00-35.00	.....	.....	.....	.....
Philadelphia	36.00	42.00	43.00	.....	51.00-52.00	60.00	.....
Pittsburgh	34.00-35.00	44.00-45.00	.....	47.00-48.00	51.00-52.00	.....	58.00-60.00
St. Louis*	34.00	48.00	41.00	51.00	.....	.....	50.00
San Francisco	35.00	46.00	28.00	40.00	40.00	.....	.....
Seattle	35.00	32.00	30.00	.....	.....	.....	.....

*Brokers' buying prices. **F.o.b. shipping point

Foundry Statistics



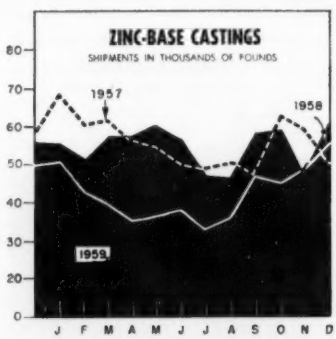
PIG IRON

PRODUCTION*—Net Tons

	Foundry	Malleable & Silvery	Low & Int. Low Phos. & Bessemer
1957	2,275,789	3,697,335	7,452,203
1958	1,622,320	2,448,917	4,954,854
1959			
Jan.	190,392	263,105	479,019
Feb.	121,716	258,250	312,284
Mar.	173,881	341,218	412,533
April	159,950	296,384	427,227
May	198,126	358,087	474,820
June	188,158	346,231	441,052
July	166,378	173,760	258,935
Aug.	N.A.	N.A.	N.A.
Sept.	N.A.	N.A.	N.A.
Oct.	N.A.	N.A.	N.A.
Nov.	148,660	180,927	216,063
Dec.	177,017	306,303	452,426
Totals[3]	1,341,572	2,607,339	536,688
1960			
Jan.	128,232	326,383	462,667

CONSUMPTION*—Gross Tons

	Cupola	Air	Electric
1957	4,160,891	218,178	246,851
1958			
Nov.	287,013	14,862	31,397
11 mo.	2,992,911	152,657	205,695
Dec.	321,741	16,610	25,450
Total	3,314,652	169,267	231,145
1959			
Jan.	321,302	17,113	36,783
Feb.	324,876	17,960	37,414
Mar.	353,985	20,625	42,464
Apr.	366,378	21,997	41,597
May	358,192	20,424	40,812
June	366,136	20,390	39,867
July	311,327	16,391	20,427
Aug.	288,547	15,937	4,923
Sept.	336,015	18,057	6,033
Oct.	351,679	20,011	5,749
Nov.	276,168	16,350	28,231
11 mo.	3,654,605	205,255	304,310



ZINC-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1957	669,775	431,509	.....
1958			
Dec.	64,574	46,236	56,756
Total	590,071	409,471	.....
1959			
Jan.	55,439	38,661	61,192
Feb.	51,368	35,478	57,437
Mar.	57,609	40,700	62,657
Apr.	57,325	40,127	55,916
May	60,654	43,920	62,224
June	56,128	40,226	54,097
July	46,756	34,606	52,677
Aug.	46,566	34,682	56,090
Sept.	58,144	40,397	60,953
Oct.	59,214	42,594	57,814
Nov.	46,720	37,410	58,076
Dec.	60,652	39,562	64,913
Total	656,566	468,363	.....

MAGNESIUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1957	30,322	28,452	.....
1958			
Dec.	2,806	2,306	5,115
Total	28,776	25,024	.....
1959			
Jan.	2,291	2,086	5,001
Feb.	2,249	1,995	4,637
Mar.	2,129	1,924	4,465
Apr.	2,455	2,213	4,787
May	2,370	2,093	5,102
June	2,484	3,207	4,664
July	2,265	1,875	3,995
Aug.	2,243	1,753	3,809
Sept.	2,263	1,832	3,823
Oct.	2,436	1,890	3,501
Nov.	2,023	1,628	3,281
Dec.	2,163	1,731	3,423
Total	27,371	24,227	.....

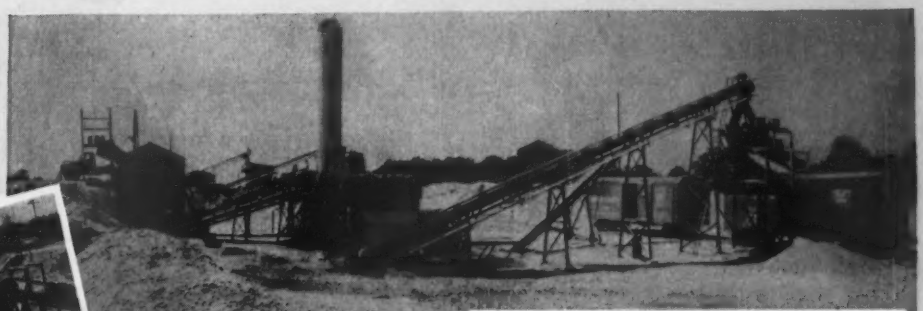
*Source: U. S. Dept. of Interior, Bureau of Mines. **Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For sale only. [3]Monthly figures do not add up to totals shown because of unreported monthly revisions.

NOW YOU CAN BUY DORCHESTER MC* SAND MULLED

CAN'T FREEZE

SAVES MONEY

READY TO USE



Muller of new design manufactured by National Engineering Company

Another first! Whitehead's new plant at Dorchester. View shows how sands are processed and loaded on freight cars by equipment of latest design.

WHITEHEAD'S

*MOISTURE CONTROLLED AND MULLED *NATURAL BONDED* DORCHESTER MOLDING SANDS AND GRAVELS

Guaranteed Moisture Content Not Above 6%

With Whitehead's new plant in full operation, Dorchester Molding Sands arrive at your foundry completely mulled, if so ordered. Each grain of sand is evenly coated with its natural bond of clay.

Widely used for Cores and Molds in Iron, Steel, Alloys, and Non-Ferrous Castings, the famous Dorchester Molding Sands are noted for Colloidal clay giving high green and dry strength. Because of the low fines in grain distribution, these sands have a high permeability.

1 ***Moisture Controlled Sands Do Not Freeze—***

a. Easier to unload . . . means lower unloading costs.

b. Reduces handling costs to and from storage bins.

2 ***Moisture Controlled Sands Are Economical—***

a. Sand with 15% moisture have 1700 lbs. sand and 300 lbs. water in each ton.

b. Moisture Controlled Sands with 6% moisture have 1880 lbs. sand and 120 lbs. water in each ton.

c. On each ton of Moisture Controlled Sands you SAVE price of sand and freight on 180 lbs. of water. Sand has just right amount of moisture to eliminate dust hazard.

3 ***Ready to Use on Arrival at Foundry—***

a. Dorchester Moisture Controlled Sands and Gravels arrive with proper working moisture content so that they can be used at once.

b. Aids you in control for sand at foundry.

Whitehead Brothers COMPANY

Established 1841

NEW YORK OFFICE
324 West 23rd St., New York 11, N. Y.

NEW ENGLAND OFFICE
75 Westminster St., Providence 1, R. I.

Manufacturers of:

LYQUAGRIP
Ready-to-use core paste

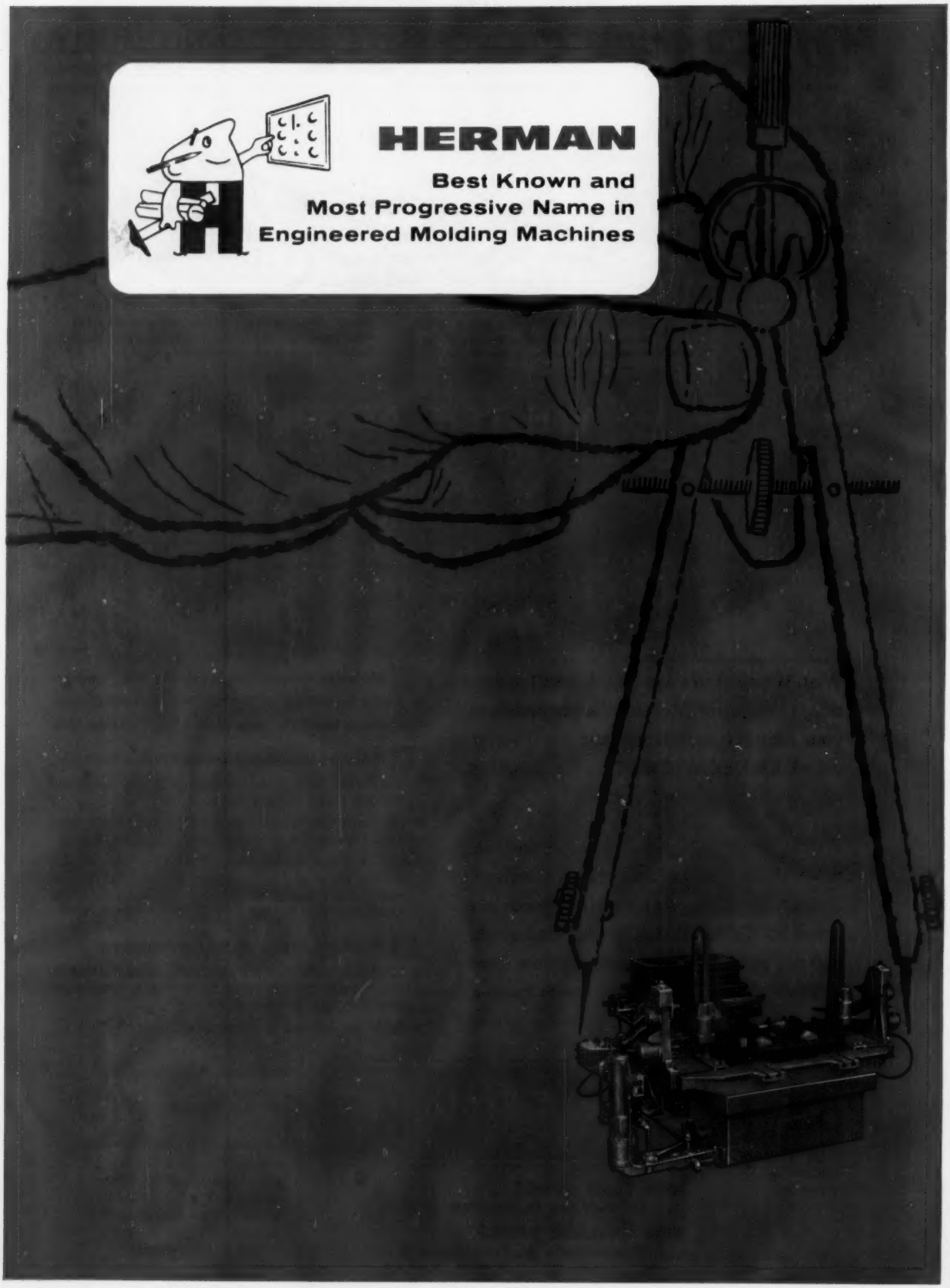
DOB-IT
Ready-to-use core mudding compound

JOINT-SEAL
Plastic compound for perfect sealing

LYQUAFLOUR
For cleaner surfaces, better shakeout

LYQUAFACE
The liquid sand grain coating

Circle 579 on Page 53


HERMAN
Best Known and
Most Progressive Name in
Engineered Molding Machines

The completely assembled Jolt Rollover and Draw Machine

Here is another example of the way plus engineering is worked into our standard machines, to give foundrymen the benefit of progressive thinking.

The 750—1500 lb. Herman Jolt Rollover and Draw Machine comes to you completely assembled. Fast installation keeps costs down. No pit type foundation is required and of course all repairs are made at floor level.

One rotary type valve controls all operations simply and easily. Air-on-oil hydraulic controls eliminate jerking and slamming, and induce smooth, fast rollover and draw. The pattern draw equalizer compensates for any irregularities in the flask or bottom board. The machine makes perfect molds of any depth and deposits them directly on the conveyor.

Wear plates reduce wear on piston and cylinder, and no disassembly is necessary to make adjustments for alignment.

There are many other operating features on this particular Herman machine you should know about.

They all add up to a discovery thousands of foundrymen have made about Herman equipment: It is *engineered* with the objective of better production, less cost, fast amortization and industry-improvement.

If this is *your* goal, why not call in a Herman engineer *today*?

HERMAN PNEUMATIC MACHINE CO.
UNION BANK BUILDING, PITTSBURGH 22, PA.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Circle 580 on Page 53

To a generation of our fighting forces, this slogan meant a way to stay alive. Doesn't it have a less dramatic parallel in industry today?

We *have* to know or lose out to competitors who do. Are we building acceptable quality? ... Are rejects needlessly high? ... Are we losing profitable production as a result or falling behind on delivery schedules? ... How many customers may we lose this way? ... And who gets blamed?

If any of these are your personal or company worries, we believe we can help you find an answer through the right nondestructive testing system. "Right" because there's a Magnaflux System pinpointed to your needs ... whether to meet tightest specifications, job lot testing, or highest speed production testing.

From Magnaflux you'll find a recognized reliable supplier, with the greatest number of specialized test systems, and the widest selection of equipment and models in each to meet your specific needs. Standard or tailor-made, there's test equipment to do your work precisely and economically.

Your wisdom in selecting a Magnaflux System is supported by leading engineers, production managers and testing laboratories; — more Magnaflux Systems are used for more test operations than all others combined. The tests apply to *any* solid material, metal or non-metal—even for hardness, conductivity, or alloy composition.

Incidentally — and to any extent you may want it — our service includes a recognized standard of complete and impartial on-the-spot counsel, training courses, research developments to meet individual problems and prompt contact with some of the world's finest testing engineers. We say this right out, because nondestructive testing now has been our full time occupation for 30 years.

Why not talk to a Magnaflux Engineer *now*. Even if you don't have pressing problems at the moment, it's a good way to be sure you'll *stay* out of trouble.

As your "House of Answers" Magnaflux offers you:

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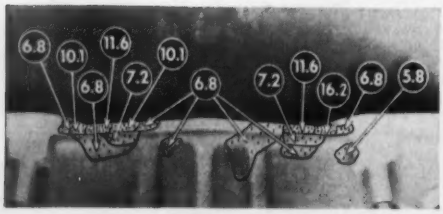
The Hallmark of *Quality* in nondestructive test systems

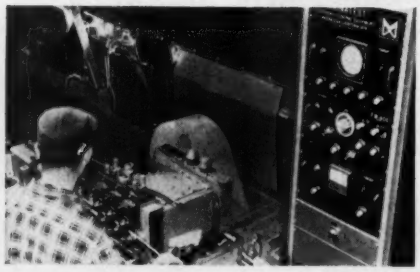
MAGNAFLUX-MAGNAGLO to test magnetic materials for cracks, etc.

ZYGLO for nonmagnetic and other materials (Shown: Complete Portable Kit, $125.00)

SONIZON Ultrasonic Testing



STRESSCOAT to find and measure stress on parts.

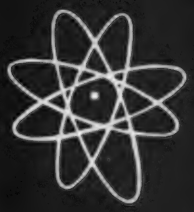


MAGNATEST electronic testing for hardness, conductivity, alloy, proximity, and many more.

And still other methods and techniques, some completely new.

Circle 581 on Page 53

Circle 582 on Page 53→



AUTOMATION + B & P FLEXIBILITY =

FLEXIMATION

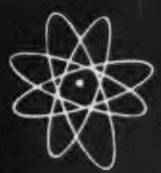
that's the story behind the "SLINGER with a memory"

the

AUTOSLINGER

... WITH MICRO-PATH CONTROL

from Beardsley & Piper Research

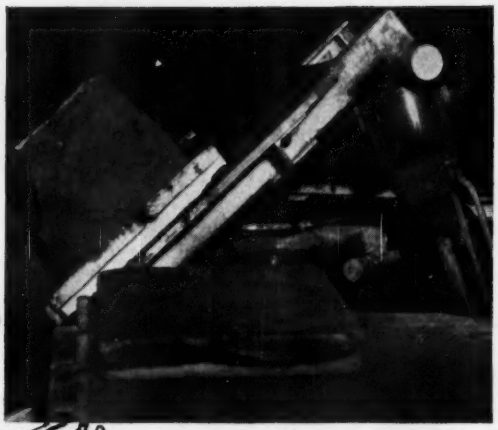


see it at the AFS Foundry Show

THE AUTOSLINGER'S MEMORY WILL SAVE YOU MONEY!

Mechanize with Jeffrey

Jeffrey Universal Mold Conveyor is positively hinged vertically and horizontally, to permit varying elevations to match best work height.



Automatic mold dump eliminates manual effort in normally hazardous area.

WHEN YOUR MOLDS RIDE ...you save time

Jeffrey offers floor type and pendant type (trolley) Mold Conveyors. Both are extremely flexible—can go where you want them to go and at low initial cost. The floor type can be equipped with automatic mold dump, pin-pointing the shakeout operation.

These systems can save you time—and time is money. Write for Catalog No. 911, The Jeffrey Manufacturing Company, 907 North Fourth Street, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

OTTAWA Round-Grain SILICA

...BETTER 4 WAYS

- Excellent flowability
- Low bond requirements
- High permeability
- Cleans easily–no breakdown during reclamation

Write today for your free copy of OTTAWA'S new brochure

99.9% pure SILICA

Serviced by truck, barge and two main trunk railway systems, Ottawa Silica offers fast delivery to all corners of the nation.

OTTAWA SILICA COMPANY

PLANTS LOCATED IN
OTTAWA, ILL. ROCKWOOD, MICH.
CONNECTICUT AND CALIFORNIA

Circle 584 on Page 53

A Timely Message for Foundry Managements

MODERNIZATION
MECHANIZATION
AUTOMATION

Knight Engineering has assisted in the modernization, mechanization and automation of hundreds of foundries, here and abroad. These programs have increased production per man hour, established equitable rate structures and eliminated overtime. Specific programs are based on the individual requirements of the foundry and include the degree of modernization, mechanization and automation that is economically justified. Many projects permit direct labor and material cost reductions to amortize the investment in 2 or 3 years. Knight Professional Foundry Engineering is readily available to assist in planning your modernization program.

KNIGHT SERVICES INCLUDE:

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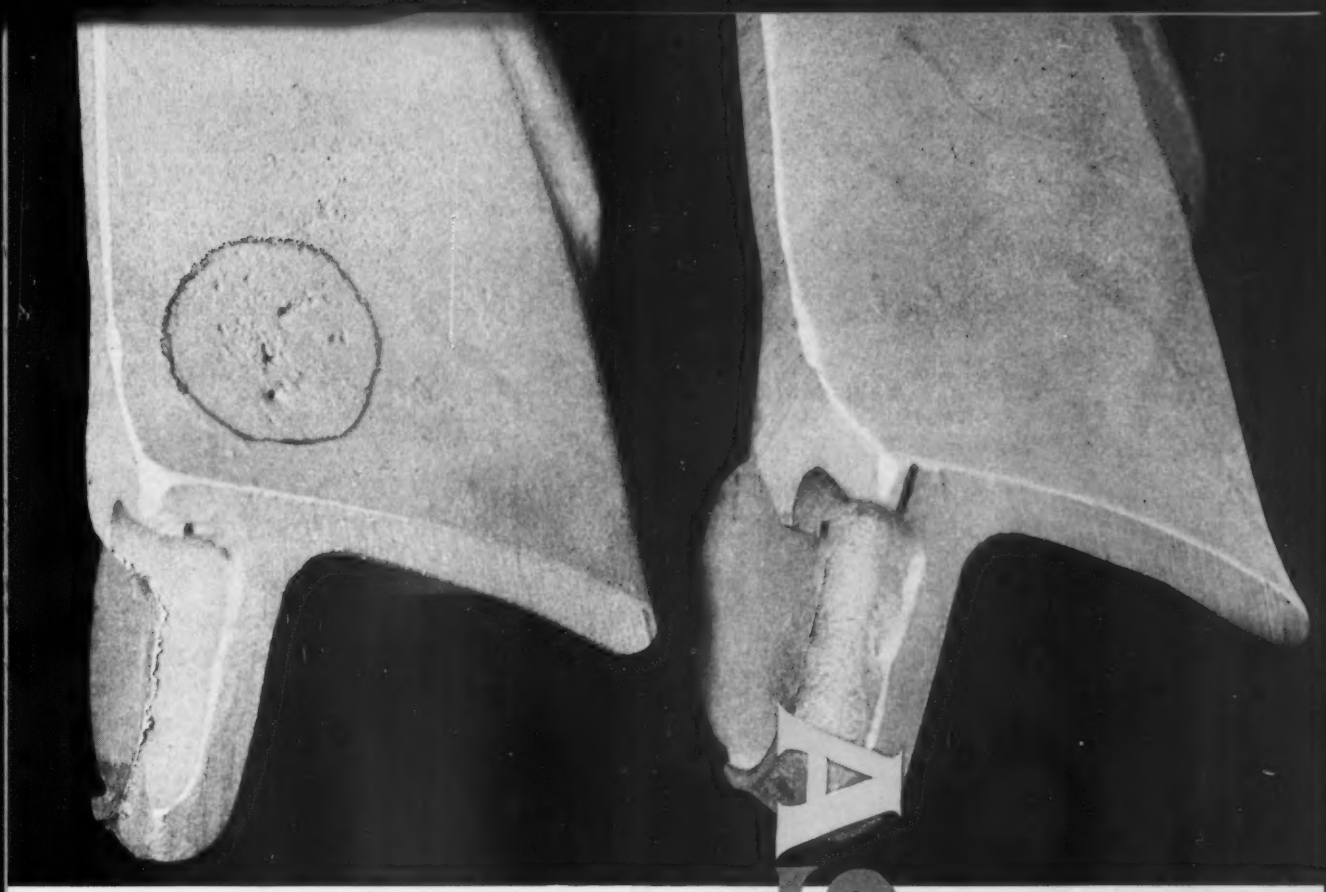

Now ASARCO process reduces and controls shrinkage

FEDERATED PT (pressure-tight)
ALUMINUM CASTING ALLOYS

Use PT-processed metal instead of any of the standard sand and permanent mold aluminum casting alloys. Result: no unpredictable shrinkage. No need for extra gates and risers. Higher yield per pound of metal. More uniform pressure-tight castings. A brighter cleaner surface. All the same physical and mechanical properties and characteristics. Write or call today for full information about PT grade aluminum, to Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, RE 2-9500; or call your nearest Federated sales office.

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

Comparative photograph illustrates the effect of PT treatment. Casting on left from standard aluminum alloy, shows typical shrinkage over a large area. Compare with casting on right, cast in PT grade, under the same conditions! Alloy: F460 (319)

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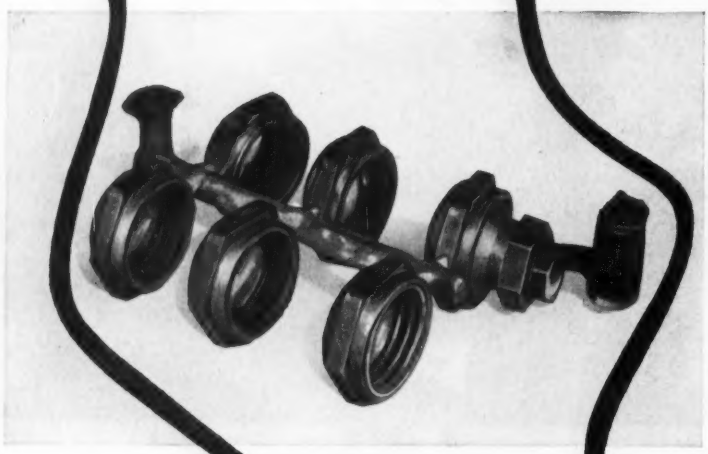
IN CANADA: Federated Metals Canada, Ltd.
Toronto, Ont., 1110 Birchmount Rd., Scarborough, Phone: Plymouth 73246

Montreal, P.Q., 1400 Norman St., Lachine, Phone: Melrose 7-3591

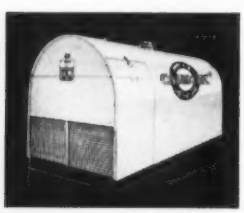
Circle 586 on Page 53

THE SHAPE OF THINGS TO COME...

castings made faster and to critical tolerances



Typical castings from the Cardox CO_2 molding process. These blast furnace union nuts need only blast cleaning. At right, a union on sprue is screwed into nut.



SEE US AT THE FOUNDRY SHOW, BOOTH 1009, PHILADELPHIA, MAY 9-13

To Get The Most From Your CO_2 Process

CARDOX® CO_2-

in any form, when you need it

Bulk Liquid Carbon Dioxide—ready for use at your plant. Cardox Storage Units, installed without capital investment on a "keep full" user contract basis, are supplied with CO_2 by Cardox' fleet of trucks and rail tank cars from over 60 plants and depots. You pay only for the CO_2 used, nothing for maintenance or up-keep. CO_2 cylinder gas, dry ice and converters also available.

CARDOX CO_2

SEMI-PRECISION MOLDING PROCESS

Close tolerances and savings in time are only two of the many advantages you gain with this new improvement in the CO_2 core hardening process. You also get smoother casting finish and achieve important savings in money.

For example, one company was able to shave the cost of producing a small casting from $1.07 before milling to only $.37. In addition, the same company to avoid milling had to maintain tolerances of only ± 0.029 in. Yet tests indicate that tolerances of as little as ± 0.005 in. can be held on small castings if it becomes necessary.

This has become possible even though full core and mold hardening has been reduced to only 10-12 seconds. This time has been cut even more in other foundries. Set-up time is reduced, too, and core storage and core dryers are eliminated, freeing more space for actual production.

Those companies already capitalizing on these advantages have found that production has been increased with little or no capital outlay for new equipment, and existing production methods have required no major change. The same could hold true for *your* foundry.

Contact your nearest Cardox representative and write for your copy of the illustrated case history, "CO_2 Core Handling Enables Two Pittsburgh Foundries to Improve Precision, Speed Production."

CARDOX DIVISION OF CHEMETRON CORPORATION
Dept. 431, 840 N. Michigan Ave., Chicago 11, Ill. CHEMETRON

REGIONAL OFFICES: Jersey City, N. J. 7th & Provost Sts. | Detroit, Mich. 1723 W. Lafayette Blvd. | Fort Worth, Texas 825 N. Calhoun St. | Memphis, Tenn. 784 Mississippi St. | Chicago 9, Illinois 43rd & Marshfield | Los Angeles, Calif. 151 North Avenue 19

CARDOX® PRODUCTS: Carbon Dioxide Fire Extinguishing Systems, Trucks, and Foam Fire Equipment . . . Liquid Carbon Dioxide . . . Carbonic Gas . . . Dry Ice

Circle 587 on Page 53

Common-sense design assures effective heat transfer
Link-Belt Roto-Louvre has largest volume of air penetrating thin bed of sand near feed end, where greatest evaporation takes place. Gradual heat transfer from gentle rolling action of sand over slowly revolving louvres eliminates spotty over- and under-drying.
The Roto-Louvres below, installed at a large midwest automotive foundry, receive sand having moisture of 8%. They dry the sand to a moisture content of .75% and discharge it at 135°F. Using 80°F air, a Roto-Louvre cooler then reduces the sand to 100°F and .5% moisture.
60 TPH OF DRY COOL SAND

. . . with LINK-BELT Roto-Louvre dryers and cooler

Two Link-Belt Roto-Louvre dryers and one cooler have eliminated a costly sand shortage problem for a large midwest automotive foundry.

Because their old system was inadequate and antiquated, additional dried sand had to be purchased at premium costs. Now, with the high-capacity Link-Belt dryers and cooler, production needs are easily met. What's more, the new system is designed to handle anticipated future needs.

This is just one of many foundries that have found Link-Belt Roto-Louvre to be the low-cost answer to needed capacity. Roto-Louvre efficiency results from an exclusive design that assures positive temperature control . . . and uniform air contact with *every* grain of sand.

Roto-Louvres can be used as dryers, dryers-coolers or coolers. For details, contact your nearest Link-Belt office. Or write for Foundry Equipment Book 2423 and Roto-Louvre Book 2511.

LINK-BELT

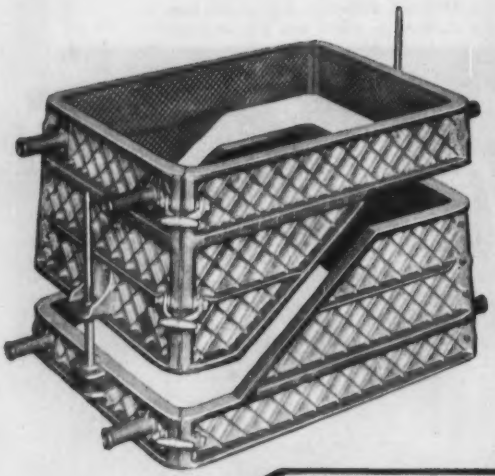
HANDLING AND SAND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses and District Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 10.288

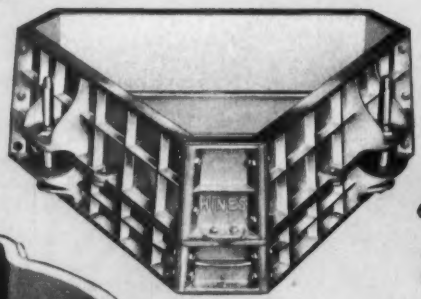
64th Castings Congress and Foundry Show, Philadelphia May 9-13, Convention Hall, Booth 1428.

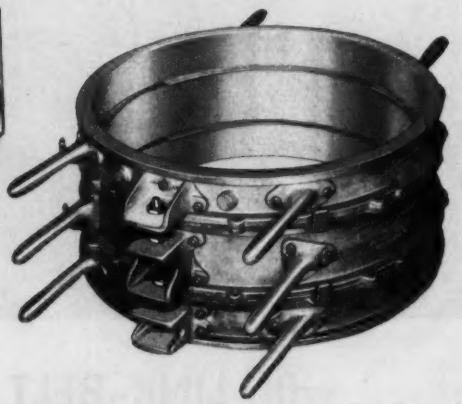
Circle 588 on Page 53

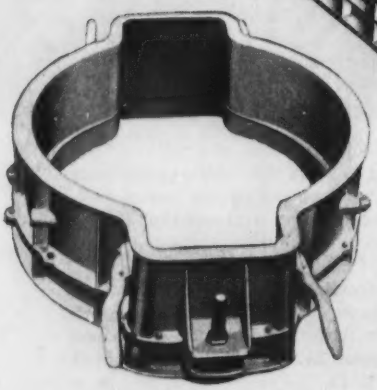
HINES SPECIAL FLASKS

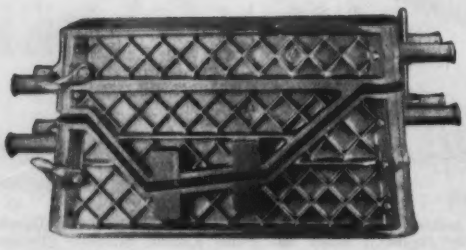


• Shown here are but a few of the many special flasks designed and fabricated by HINES to do difficult molding jobs more efficiently. In many cases, HINES has been able to design flasks for making castings previously considered impractical, if not impossible to produce. Many of these special flasks incorporate the familiar HINES "POP-OFF" corner release mechanism, to further speed up production, increase accuracy of the mold and prolong flask life.









It's entirely possible that a HINES "special" may be the answer to that difficult molding problem now confronting you. Our engineering department will gladly submit recommendations. A phone call, wire or letter will put them on the job at once.

THE HINES FLASK CO.

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HINES FLASKS

Circle 589 on Page 53

Vancoram briquettes

make mistakes hard to make! Mistakes cost money–but distinctively shaped Vancoram Briquettes cut errors to the bone. They help assure that the right amount of the right alloy gets into every melt. VCA supplies every major type: FERROSILICON (Cylindrical), FERROMANGANESE (oblong), FERROCHROMIUM (hexagonal), and SILICOMANGANESE (square). Every one sets a standard of excellence! Get Vancoram Briquettes in bulk, bags, or pallet boxes. Call your VCA representative for facts and figures—or any of the VCA Distributors listed below. Vanadium Corporation of America, 420 Lexington Avenue, New York 17, N.Y. Chicago • Cleveland • Detroit • Pittsburgh

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Be sure to visit our Booth (No. 1414) at the AFS Castings Congress, Philadelphia, May 9-13.

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Circle 590 on Page 53

Announcing

A SPECIAL REPORT

The Dynamic Metal Casting Industries

MEET THE CHALLENGE OF THE SOARING 60s

AN EDITORIAL PRESENTATION
IN FOUR SECTIONS

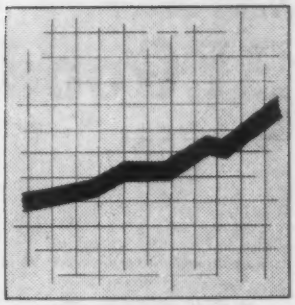
The editors of FOUNDRY announce plans for another special report to the metal casting industries. This year's contribution to foundry planning is designed to help foundrymen share in the opportunities of the long-heralded decade of the Soaring Sixties. It will appear in the May, 1960, Pre-Convention issue of FOUNDRY to be published immediately prior to the 64th Castings Congress and Foundry Exposition of the American Foundrymen's Society (Philadelphia, May 9-13).

It's COMING - - - a truly outstanding FOUNDRY editorial package

MAY 1960 PRE-CONVENTION ISSUE

1. WHAT ARE FOUNDRYMEN PLANNING?

A report of an intensive study of foundry equipment purchases planned for the next two years will be made. Plant expansion projects by metal casting companies are an important part of this picture, and they, too, will be reported. Foundries, large and small, will be included in this report, which will be of unusual interest as an indication of the manner in which foundrymen are gearing up for tomorrow's production requirements.

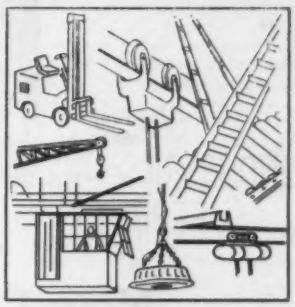


2. INVENTORY OF FOUNDRY EQUIPMENT

FOUNDRY's editors and market research staff have joined forces to make this special study. (This inventory is conducted every five years.) It includes 65 different types of equipment in ten major categories. Use of equipment in different types and sizes of foundries, relative age of equipment, and other pertinent data will, as always, be of considerable interest to foundrymen—and to equipment makers whose function it is to fill metal caster's needs.

3. WHEN SHOULD FOUNDRYMEN PURCHASE EQUIPMENT?

Much has been written and spoken on this vital question. The editors have studied existing information and opinions on the subject and will present recommendations of equipment manufacturers to foundrymen. Attention will be given to the needs of the small plant as well as to those of the large producer.



4. WHAT FOUNDRIES CAN GAIN BY MODERNIZING

Modernization and mechanization of castings production equipment has been going on for many years. Now foundrymen are paying special attention to this avenue to increased profits. Indications are that the 60s may truly be just the beginning of real modernization of facilities. The editors have chosen appropriate case histories of plants which *have* modernized successfully for presentation in this year's special editorial package.

Plus... **The May Pre-Convention issue will carry program details on the Philadelphia Convention in addition to regularly scheduled features. It will be mailed to reach foundrymen well in advance of the convention.**

BUSINESS MAGAZINE OF THE DYNAMIC METAL CASTING INDUSTRIES

FOUNDRY
A PENTON PUBLICATION
Penton Building, Cleveland 13, Ohio

News about

B.F.Goodrich Chemical *raw materials*

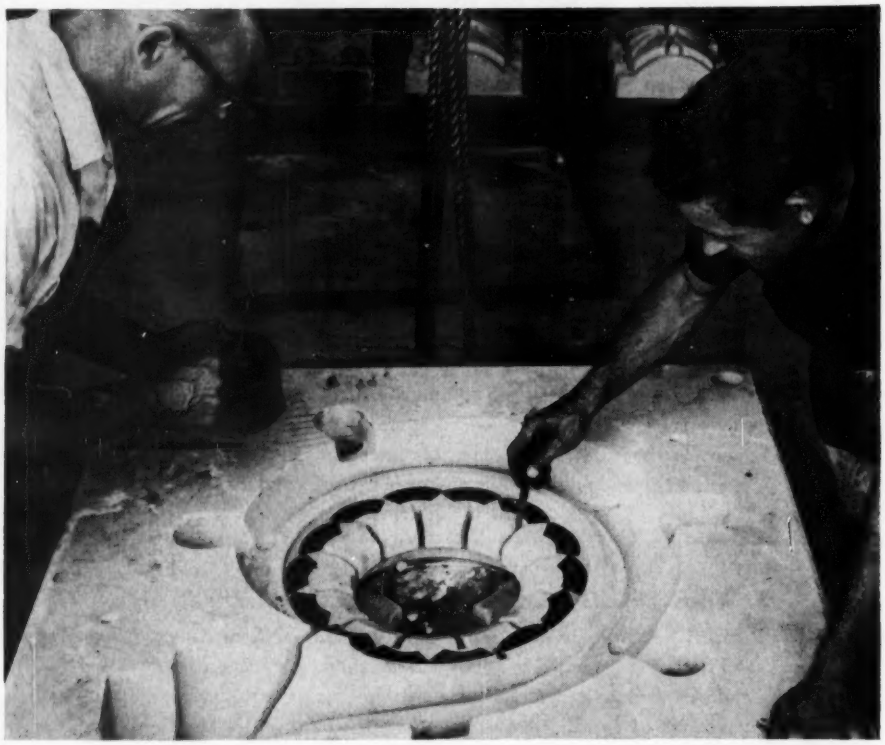


Photo shows finishing operations on large dry-sand mold for precision casting at Solon Industries, Inc., Solon, Ohio.

SOLON INDUSTRIES, INC. REPORTS:

New Good-rite CB-40 improves casting quality, reduces scrap

Here's what Solon Foundry, Subsidiary of Solon Industries, Inc., Solon, Ohio, has to say about the use of Good-rite CB-40, the new low-gassing mold and core binder designed for light metal precision casting:

Low-gassing: At Solon, the exceptionally small amounts of gas produced by Good-rite CB-40 mean that blow holes are practically eliminated. At the same time, since scrap is considerably reduced, savings are sizeable.

Finer finishes: Good-rite CB-40 permits the use of finer sands to produce exceptionally smooth finishes and eliminate machining operations. Tolerances are closer, too, since it is possible to cast far more accurately than with other core binders.

Other advantages: Good-rite CB-40 provides dimensional stability, excellent collapsibility and shakeout, and more efficient baking—no critical oven control needed. It can be used with any present method and is safe at all stages—will not burn, releases no objectionable fumes.

You can get more information about Good-rite CB-40 by writing Dept. JE-2, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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406	436	466	496	526	556	586	616	646	676	706	736	766	796	826	856
407	437	467	497	527	557	587	617	647	677	707	737	767	797	827	857
408	438	468	498	528	558	588	618	648	678	708	738	768	798	828	858
409	439	469	499	529	559	589	619	649	679	709	739	769	799	829	859
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411	441	471	501	531	561	591	621	651	681	711	741	771	801	831	861
412	442	472	502	532	562	592	622	652	682	712	742	772	802	832	862
413	443	473	503	533	563	593	623	653	683	713	743	773	803	833	863
414	444	474	504	534	564	594	624	654	684	714	744	774	804	834	864
415	445	475	505	535	565	595	625	655	685	715	745	775	805	835	865
416	446	476	506	536	566	596	626	656	686	716	746	776	806	836	866
417	447	477	507	537	567	597	627	657	687	717	747	777	807	837	867
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420	450	480	510	540	570	600	630	660	690	720	750	780	810	840	870
421	451	481	511	541	571	601	631	661	691	721	751	781	811	841	871
422	452	482	512	542	572	602	632	662	692	722	752	782	812	842	872
423	453	483	513	543	573	603	633	663	693	723	753	783	813	843	873
424	454	484	514	544	574	604	634	664	694	724	754	784	814	844	874
425	455	485	515	545	575	605	635	665	695	725	755	785	815	845	875
426	456	486	516	546	576	606	636	666	696	726	756	786	816	846	876
427	457	487	517	547	577	607	637	667	697	727	757	787	817	847	877
428	458	488	518	548	578	608	638	668	698	728	758	788	818	848	878
429	459	489	519	549	579	609	639	669	699	729	759	789	819	849	879
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418 448 478 508 538 568 598 628 658 688 718 748 778 808 838 868
419 449 479 509 539 569 599 629 659 689 719 749 779 809 839 869
420 450 480 510 540 570 600 630 660 690 720 750 780 810 840 870
421 451 481 511 541 571 601 631 661 691 721 751 781 811 841 871
422 452 482 512 542 572 602 632 662 692 722 752 782 812 842 872
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206 FLEETS

Among METAL PRODUCING MILLS and FOUNDRIES in the United States and Canada operating 3 or more "PAYLOADER" units totaling

1518 MACHINES

It is significant that there are more "PAYLOADER" tractor-shovels in the Foundry and Metal working industries than all others combined. In addition to fleet owners, thousands of individual owners dating back as far as 20 years ago, have bought "PAYLOADER" over and over again for this rugged work . . . proof of the satisfactory performance and dependability built into each machine.

Among the many fleet owners is the CADILLAC MALLEABLE IRON CO. of Cadillac, Michigan, who today are using 5 "PAYLOADER" tractor-shovels. Their first "PAYLOADER" was purchased back in 1945. Mr. Whaley, company treasurer, says, "We wouldn't have used "PAYLOADER" units exclusively for 15 years if we didn't like the equipment."

The "PAYLOADER" units are used to unload sand from boxcars, haul sand and castings to shake-out hopper, haul sand to muller and back to molding stations. In addition the machines also handle refuse, iron scrap and coke.

If you have a bulk material handling problem in your plant, see what a flexible, versatile "PAYLOADER" can do before you install any fixed material handling system. There are 20 models to choose from to fit your exact requirements. Send for complete details.

HOUGH®

THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

HOUGH, PAYLOADER, PAYMOVER, PAYLOGGER and PAY are registered trademark names of The Frank G. Hough Co., Libertyville, Ill.

THE FRANK G. HOUGH CO.
703 Sunnyside Avenue, Libertyville, Ill.

Send data on all "PAYLOADER" models and attachments.

Name

Title

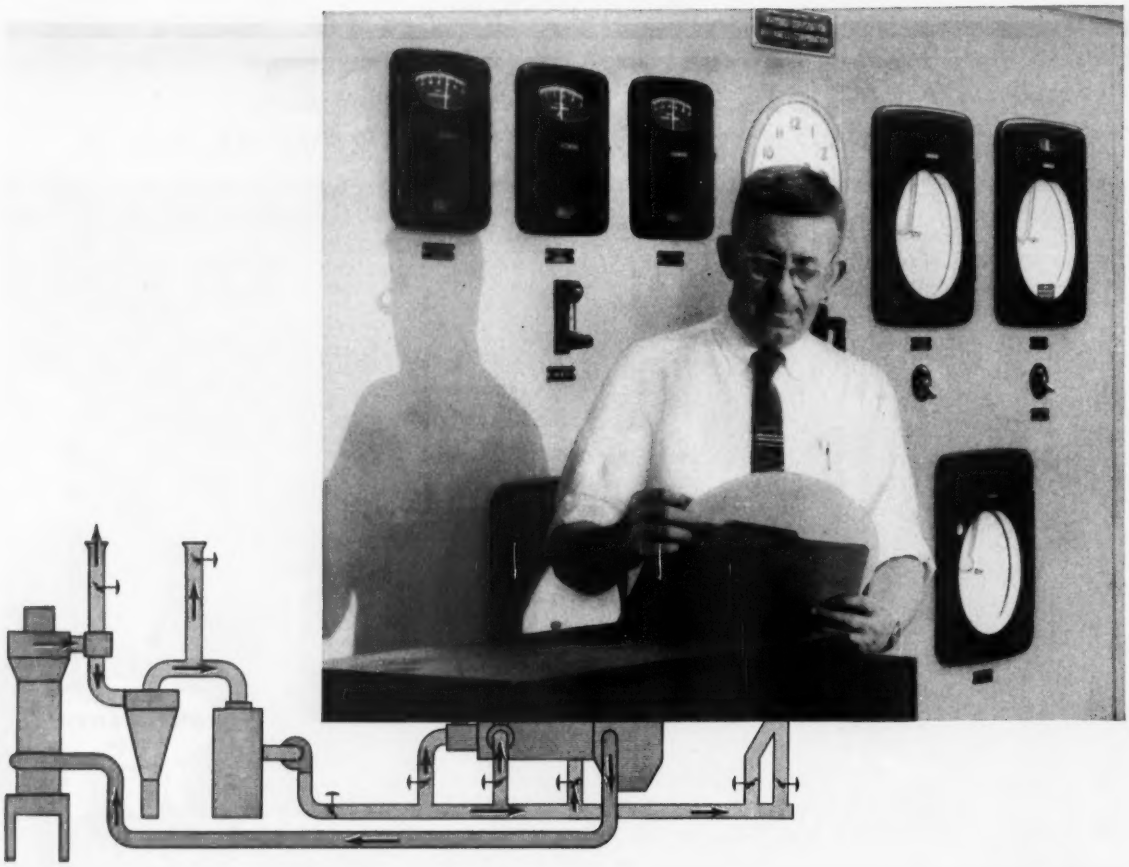
Company

Street

City State

4-A-3

Circle 592 on Page 53



Increased efficiency, lower operating costs

with Foxboro Complete Hot Blast Cupola Control

Complete instrumentation for any Hot Blast Cupola system — simple or complex. And every instrument one that's been field-proved in hundreds of foundry installations. Ask your nearby Foxboro Field Engineer for full details on the cupola control instruments listed below — or write Foxboro direct.

Air Weight Controllers

Performance-proved in more than 1700 successful installations. These popular Foxboro Controllers automatically "weigh" air for cupola blast . . . provide right amount of oxygen for best combustion regardless of weather conditions. Results: higher quality castings, greater productivity . . . fuel savings and less pigging. Write for Bulletin 10-10.

Dew Point Recorders - Controllers

These Foxboro Instruments, with the exclusive Dewcel* measuring element, reduce coke waste and "cold metal" pours. Dew Point Recorders provide a fool-proof basis for modifying the formula under varying humidity conditions. Dew Point Controllers automatically compensate for blast moisture variations on long-run heats. Write for Bulletin 11-11.

Pressure Recorders

These "trouble-shooting" recorders give operators a continuous record of cupola conditions . . . show-up clogged tuyeres, bridging, fine coke sizes, etc. They're dependable, accurate, trouble-free performers. Write for Bulletin 6-10.

Temperature Controllers

For precise control of cupola start-up operation, windbox blast air, dust collector inlet gas, and hot air generator exhaust gases. Write for Bulletin 14-10.

Other Foxboro efficiency boosters: Blast Pressure Recorders • Temperature Controllers for Pre-Heaters Pressure Controllers for Exhaust Systems • Temperature Protection for Fans and Dust Collectors.

The Foxboro Company, 324 Neponset Avenue, Foxboro, Massachusetts.

*Trade Mark

FOXBORO

REG. U.S. PAT. OFF.

COMPLETE FOUNDRY INSTRUMENTATION

MECHANI-MIZE*
FOUNDRY-WISE

WITH

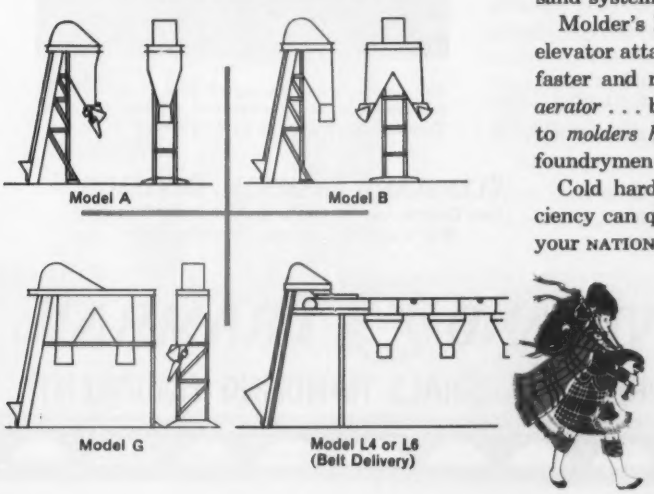
NATIONAL MOLDER'S HELPER

**Meaning . . . now it's easy and economical to get your sand up off the floor without major plant changes or big equipment investment.*

Use with any Mix-Muller:

Built for foundrymen—to increase molder's production

CHOOSE FROM A VARIETY OF ARRANGEMENTS:



Here's a compact and rugged, yet low cost, mechanized sand system, designed to get your sand up off the floor.

Molder's Helper is more than a molders hopper with elevator attached. It's an *elevayor* . . . smoother running, faster and more trouble-free than an elevator. It's an *aerator* . . . built-in unit delivers fluffy, free flowing sand to *molders hopper(s)* which are designed and built by foundrymen . . . for fast action, free flowing *foundry* use.

Cold hard dollars saved in time and increased efficiency can quickly pay for Molder's Helper. Why not see your NATIONAL representative for further details?

WRITE FOR NEW BULLETIN

NATIONAL ENGINEERING COMPANY
646 Machinery Hall Bldg.
Chicago 6, Illinois

Circle 594 on Page 53

TRAMRAIL COVERAGE *SPEEDS* FOUNDRY PRODUCTION

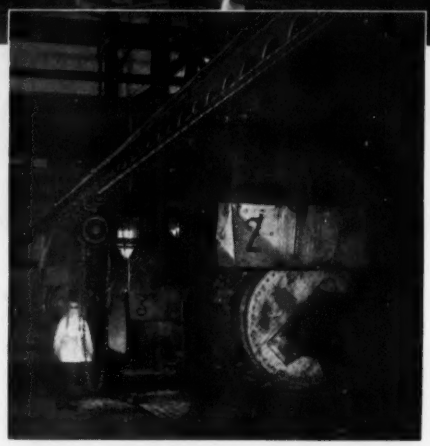
Jobbing Foundry Cuts Costs with Hand-Propelled System

Metal is quickly transferred to the hand-pouring ladles. This Cleveland Tramrail system is completely hand-propelled. Gray iron, aluminum, magnesium, brass, bronze, and monel castings are produced in this jobbing foundry.

When one considers that as much as 250 tons of materials must be moved to produce one ton of finished castings, depending on casting size, the importance of easing and speeding foundry handling is self-evident. Saving just one minute on every ton handled will reduce production time by over four hours.

Cleveland Tramrail equipment enables such tremendous time savings that frequently the output of a plant is increased by 25% to 100% without adding an additional foot of floor area.

Why not give Cleveland Tramrail a trial in your foundry? A representative will be glad to give you the details.



Bull ladles with hot metal from these electric furnaces are easily conveyed on the overhead Tramrail directly to the pouring floor.

GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

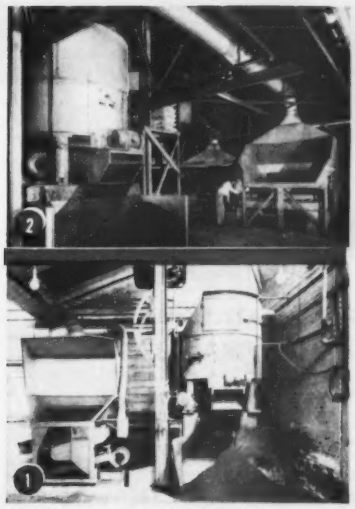
CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
3831 East 286th Street, Wickliffe, Ohio

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

Circle 595 on Page 53

MECHANI-MIZE*
FOUNDRY-WIDE
WITH
NATIONAL
UTILITY UNIT
*Meaning . . . now it's easy and economical to get your sand up off the floor without major plant changes or big equipment costs.
3

Planned, Progressive Mechanization grows with you . . . costs you less



- *Here's a start.* Mix-Muller, Loader, Screen-Master and exhausted hopper. Note magnetic separator.
- *A step further.* Heavy duty shakeout screen is added.
- *Next step . . .* elevator replaces loader and conveying equipment is added—still without major plant change or extensive pit or overhead work.

Here's an expandable sand conditioning and handling unit designed to increase your output at welcome savings in time and labor . . . without major expansion, plant change or big investment in mechanization.

If you have a Mix-Muller, you have a start! The simple addition of a National Screen-Master, Bucket Loader and Aerator can turn your mixing operation into a conditioning plant. A front end loader will get your sand up off the floor. As your mechanization needs grow, you'll find that National has the equipment and the know-how to help you grow efficiently, economically—to a predetermined Foundry-wise plan.

Why not let your NATIONAL representative show you, by your own records, how a National Utility Unit can pay its own way in as little as two years time?

WRITE FOR LITERATURE

NATIONAL ENGINEERING COMPANY
646 Machinery Hall Bldg.
Chicago 6, Illinois

F460

Circle 596 on Page 53

For

HOT WEATHER COMFORT

...workers wear the lightest Bureau of Mines Approved Dust Respirator on the Market!

- LOW COST
- LIGHTWEIGHT
- COMPACT
- EASY TO CLEAN

AO R9100 Respirator

Very comfortable — particularly in hot weather and hot operations. Construction is simple — corrugated felt facepiece provides about 22 sq. inches filter area. Non-reversing, low resistance exhalation valve will not stick, is out of the way and easily replaceable. Unit weighs a slight 2 oz., facepiece is soft with smooth edges. Self-adjusting double headband. Compact design offers unobstructed vision — respirator may be worn with goggles or under helmet. To clean: shake, slap or airhose it.

Protects against pneumoconiosis-producing and nuisance dusts such as borax, carbon, glass, silica, grain, graphite, cement, limestone, gypsum, coke, charcoal, wood, pollen, flour, and aluminum.

NOTE: Companion model (R9100T) protects against toxic dusts not significantly more toxic than lead

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities

Your nearest AO Safety Products Representative can supply you. Always insist on AO Trademarked Safety Products.

Prevent Accidents... Maintain Production with AO SWEATBANDS

They keep sweat out of eyes and off safety lenses. Prevent accidents due to blurred vision and foreign matter from being carried into eyes — thereby reducing eye dispensary cases. Model 109B weighs only ½ oz. — absorbs many times its weight. 1¾" wide. Adjustable head strap. Keep your workers cooler, more efficient and safer.

Be Safe for Sure... with AO SURE-GUARD Equipment

ONLY MAGCOBAR HAS ALL FOUR

perfect harmony in your foundry operations

Magcobar
AGRICULTURAL AND INDUSTRIAL PRODUCTS

YELLOWSTONE, Western Bentonite
AUTO BOND, Bentonite for Gray Iron
SOUTHERN STAR, Southern Bentonite
and MAGCOBAR SERVICE.

MAGNET COVE BARIUM CORP.

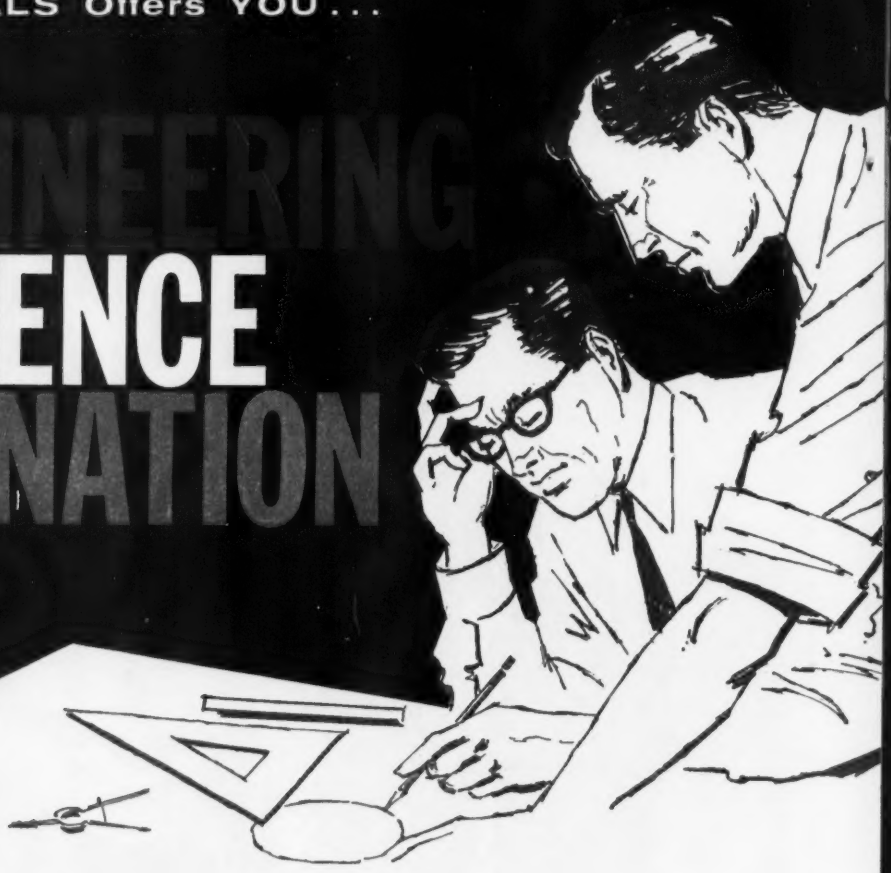
HOUSTON, TEXAS
P. O. Box 6504

ROLLING MEADOWS, ILL.
3950 Industrial Ave.

Circle 598 on Page 53

BROWN METALS Offers YOU . . .

ENGINEERING EXPERIENCE IMAGINATION



FOUNDRY MELTING EQUIPMENT designed for YOUR foundry

- WATER COOLED CUPOLAS
- 650°F-1400°F BROWN HOT BLAST
- MECHANICAL CHARGERS
- AUTOMATED MATERIALS HANDLING
- HOT METAL HOLDING AND TRANSFER UNITS
- YARD LAYOUT AND STORAGE

Call on us for quotations on any foundry engineering or operations problem — new equipment, modification of present facilities or both. Our services are flexible and designed to produce the maximum savings in capital expenditure and operating costs — no job too large or small. We offer complete erection on a turnkey basis or engineering for a specific project.

OBTAIN MAXIMUM SAVINGS ON MELTING EQUIPMENT — WRITE FOR FULL DETAILS

Foundry Engineering & Operations

BROWN METALS INCORPORATED

300 HURON STREET ELYRIA, OHIO

Telephone FAirfax 3-3291

VISIT OUR BOOTH #1210 AT THE AFS SHOW

Circle 599 on Page 53

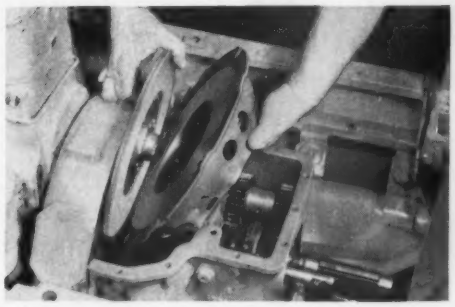
There's a dollar-saving difference in Allis-Chalmers Lift Trucks

Ask any mechanic who has serviced them all

Ask him how long it takes to prepare an Allis-Chalmers truck for routine servicing.

He can show you almost as fast as he can tell you — it takes only seconds.

Ask him how much time you save on clutch replacement.



You'll find he can change the clutch in half an hour.

Ask him how often he overhauls the Allis-Chalmers engine.

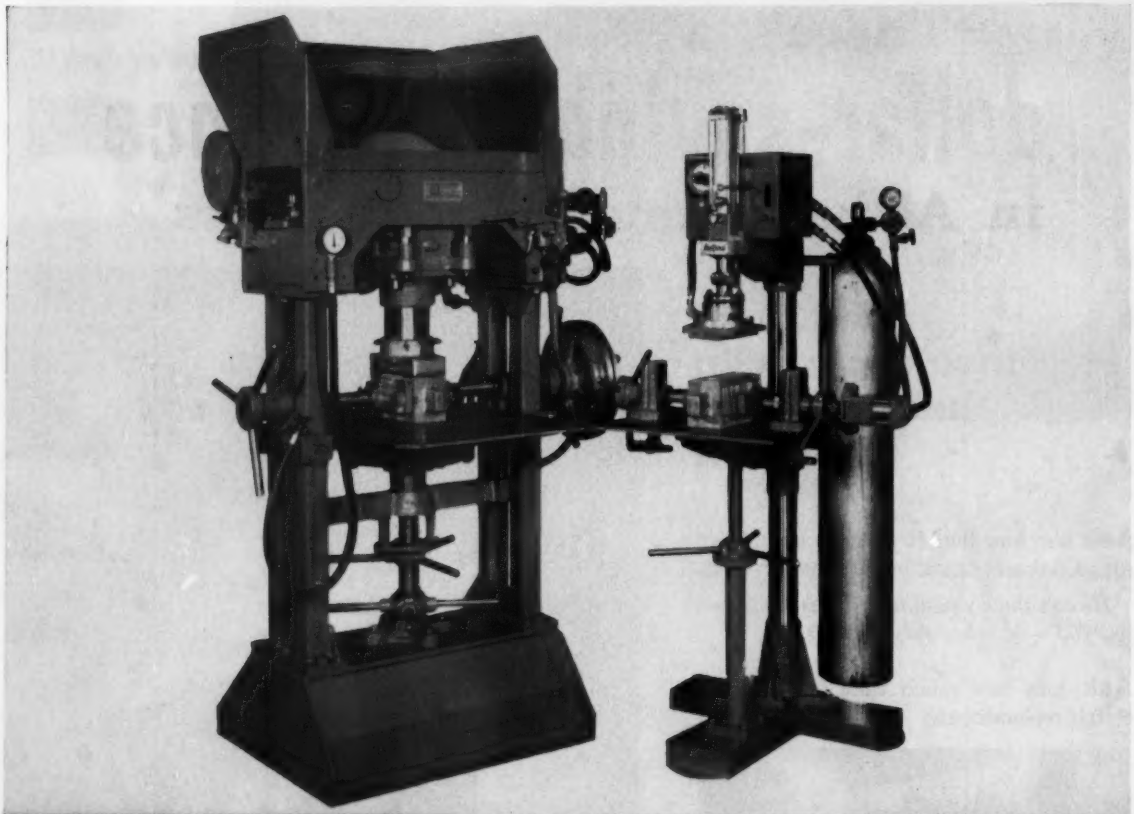
Unless he is an old-timer, he could still be waiting to overhaul his first one. Many users find Allis-Chalmers engines go 10,000 hours or more before overhaul.

Naturally, these are just a few of many examples, but even these add up to many dollars' worth of difference. Let your Allis-Chalmers dealer tell you about others — then watch an Allis-Chalmers lift truck in action. He'll be glad to arrange a demonstration . . . you'll be glad he did. Allis-Chalmers, Milwaukee 1, Wisconsin.

"Allis-Chalmers trucks are tougher than the others and require less maintenance," says the chief mechanic at a northern foundry. "I like the overhead valves and wet cylinder sleeves. I think one reason the Allis-Chalmers trucks have out-performed the other trucks is because they are easier to clean and service. We checked the fuel and they use less than the other trucks do. I'm glad to see that they are replacing the old trucks with Allis-Chalmers. This is going to make our job a lot easier."

ALLIS-CHALMERS

BH-1278



Redford

NO. 4 CORE BLOWER with MODEL H-1-E CO_2 CORE HARDENING STATION

The right tools to get maximum performance with a minimum of effort if you make cores by the CO_2 Process.

One core box is being blown while another one is automatically clamped, the cores hardened in the core box and the core box released ready to remove finished cores.

The table height of the Model H-1-E Core Hardening Station can be adjusted to correspond with the height of the core blower table. Gassing time is quickly changed to meet job requirements.

Whether you blow cores with conventional sand mixtures or use the new CO_2 Process, REDFORD EQUIPMENT gives you the best in over-all performance.

Redford IRON & EQUIPMENT CO.
20733 Glendale • Detroit 23, Michigan
Phone: KEnwood 1-8611

write for
BULLETINS 4 and H

Circle 601 on Page 53

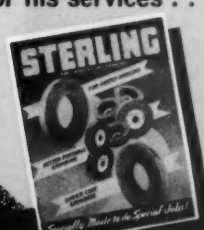
Circle 602 on Page 53→

Where machines and skills are identical, *Sterling* wheels make the Profitable Difference!

Install a Sterling Snagging Wheel on one of similar machines and check it with a competitive grinding wheel of any make. You'll quickly appreciate the longer life and better grinding that have been built into this "Wheel of Industry".

Extra grinding time means extra profits on each of your snagging jobs . . . that's why Sterling's grinding wheels mean more on any machine in your plant . . . why so many foundries use them in preference to all others . . . why you should use them in yours!

A Sterling engineer is available . . . write at no obligation for his services . . . today!



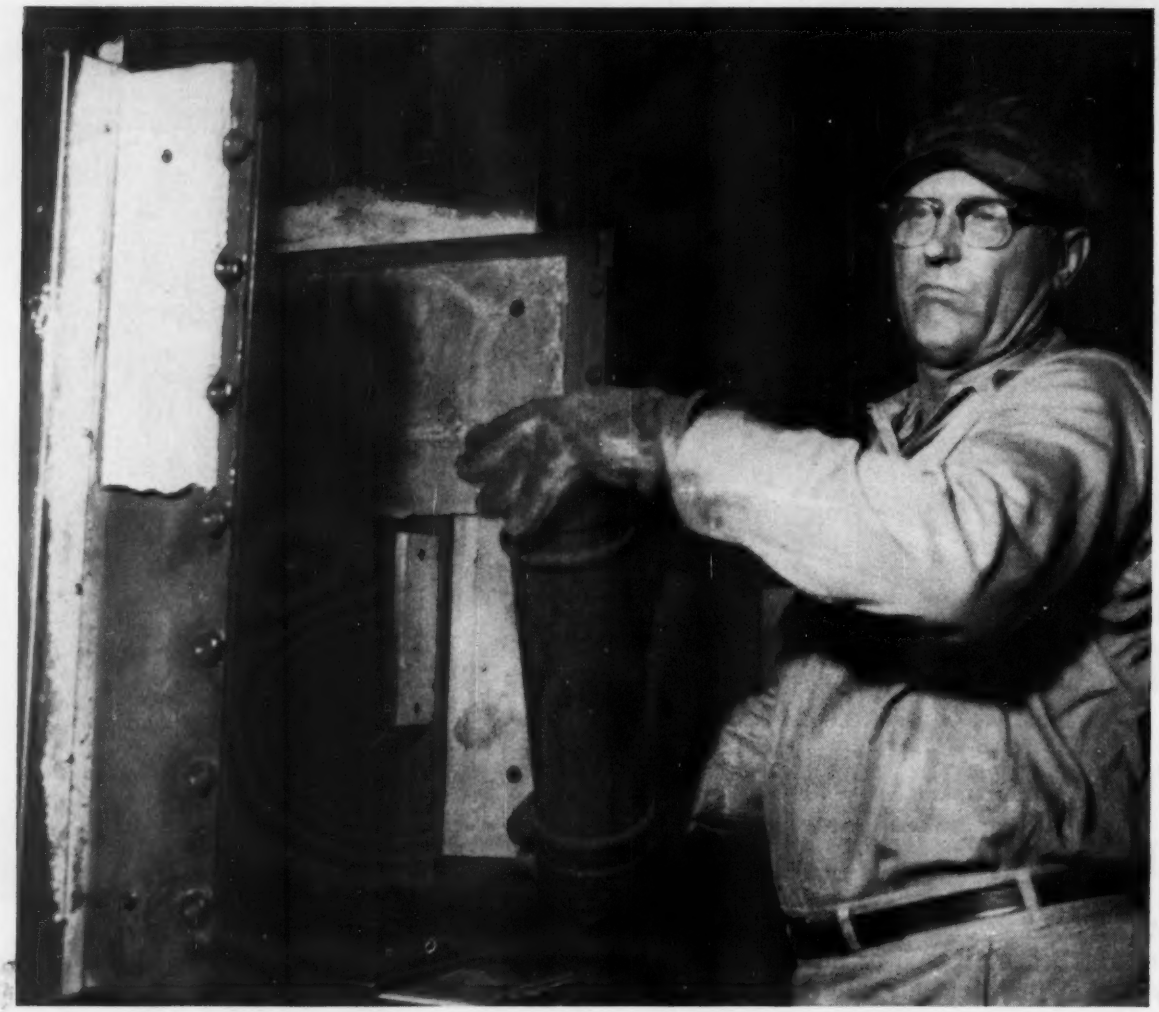
For further information on Sterling Snagging Wheels, send for the free, descriptive folder . . . describes portables, too!

For quick contact and immediate delivery, ask us for the name of your nearest Sterling distributor.

STERLING GRINDING WHEELS

THE WHEELS OF INDUSTRY
STERLING

STERLING GRINDING WHEEL CO., TIFFIN, OHIO — Distributors and Direct Representatives Located in All Principal Cities



SHELL CORES made with a Durez foundry resin now save time on half the tonnage formerly poured using green sand cores at The Kuhns Brothers Company, Dayton, Ohio. New jobs go into shell. As core boxes need replacing they are replaced by shell. Just one sand-resin mix, the outcome of intensive testing, covers every shell-core job in the foundry.

How's this for an easy way to handle big cores?

They're hollow inside. That's why they're *one-half to two-thirds lighter to lift* than solid sand cores.

You don't have to bake them like cakes in an oven. And there's no way they can get knocked out of shape before they're done.

You cure them hard right in the core box. They don't warp because they heat up evenly over the entire core surface. They come out ready for setting and pouring.

That isn't all. You can get *more accurate castings* with these shell cores—castings with 5 or 10% less dead weight that has to be machined away.

Translate that saving into pieces per ton of metal poured—and you'll see why so many foundries are interested in cores bonded with Durez resin. Yes—more profitable castings.

25% faster machining At the foundry you see here, they're tapping shell-cored pipe fittings *25% faster than ever before*—thanks to the higher feeds and tool speeds possible with the close finishing tolerances they can hold now.

Foundrymen all over the country get solid dollars-and-cents results like these with Durez foundry resins in shell cores.

They're using the experience of foundry-trained Durez technical men to make the switchover to shell cores as swift and painless as it can be.

They're keeping results *consistent* with the drum-to-drum, month-to-month sameness of Durez resin that makes it possible to set up standard procedures—and stick to them.

How about you? For competent help in shell cores and shell molding, call in your Durez man now.

DUREZ PLASTICS DIVISION

1004 WALCK ROAD, NORTH TONAWANDA, N. Y.

HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

Circle 603 on Page 53

NEWAYGO IS ON A PRODUCTION LINE BASIS TO MEET THE DEMAND FOR THE NEW EHS MODEL HANDY SANDY!

One whole section of Newaygo's manufacturing facilities, shown here, has been established for production line operations in assembling EHS MODEL HANDY SANDYS to meet the demand for this new unit, which was introduced in 1959.

One prominent West Michigan foundry recently purchased six of these EHS HANDY SANDYS in one order.

This EHS MODEL HANDY SANDY is another example of Newaygo's *leadership* in producing components for foundries — here is an expansion of the famous Handy Sandy for expansion of capacity. This "big brother of the HS Model" handles up to 20 tons of sand per hour.

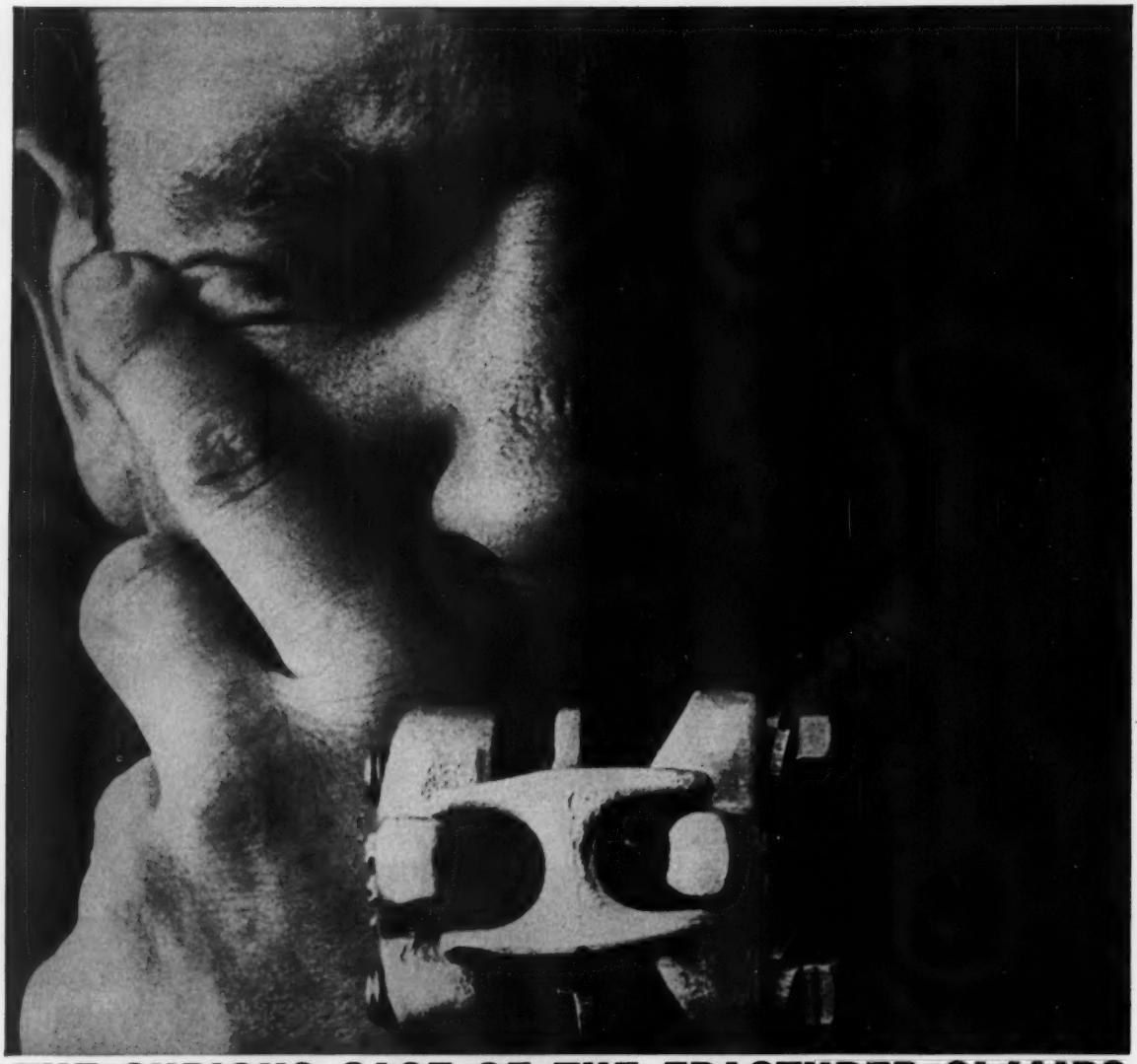
The EHS MODEL HANDY SANDY has 8-inch by 5-inch cast buckets; 10-inch wide rubber-covered elevator belt; cast head and tail pulleys; heavy duty anti-friction bearings throughout; and cutting blade type of aerator with separate motor drive.

HANDY SANDY Distribution Lines With Up to 12 or More Overhead Sand Hoppers
Here is a 4-station distribution line, plus an overflow hopper at head-end of conveyor, and fed with a 20 T.P.H. capacity MODEL EHS HANDY SANDY Elevator — aerator combination with 7-foot lower feed hopper. Four plows on overhead belt are air-operated with fully automatic controls, by using Newaygo's new MULTI-LEVEL hopper probes. This automatic control recently developed by Newaygo allows fully automatic operation of the unit, without manual attendance.

These will help YOU:
Our 16mm, 33-minute movie, "Progressive Mechanization", showing Newaygo equipment featuring HANDY SANDYS in 9 foundries. . . . Our 16mm, 35-minute movie, "Newaygo Pallet Systems for Mold Handling", presenting many types of Pallet Line Installations in foundries. . . . Our semi-monthly magazine, "SAND SCRIPTS". . . . . Our Bulletins — No. 60 on Pallet Line Systems of Mold Handling; No. 59 on HANDY SANDYS: No. 56 on Newaygo Sand Handling, Mold Handling and Mold Making Equipment.

"Foundry Business is **BIG** BUSINESS . . ."

NEWAYGO engineering company
NEWAYGO, MICHIGAN
. . . and profitable, too, with NEWAYGO MOLD HANDLING, SAND HANDLING AND CONDITIONING EQUIPMENT
Also Manufacturers and Installers of MULTI-LEVEL HOPPER CONTROL SYSTEMS, CAR CONVEYORS, APRON CONVEYORS, ROTARY FEEDERS and FOUNDRY AUTOMATION



THE CURIOUS CASE OF THE FRACTURED CLAMPS

Another costly mystery solved—by the man from Kaiser Aluminum

THE PUZZLING FACTS. A Kaiser Aluminum customer had been manufacturing an electrical connector clamp from a casting of primary standard 356 aluminum alloy. But—he often experienced difficulties due to cracking and breakage in use. What to do?

HOW THE CASE WAS SOLVED. After an on-the-scene check, the man from Kaiser Aluminum came up with the answer. His recommendation: use Kaiser Aluminum Alloy A-356, a *high purity* alloy specially developed to provide greater ductility and strength in just such castings as these. Result: a superior clamp that developed a reputation of reliability for the manufacturer—and much additional business.

WE LOVE A MYSTERY. This is one of many actual cases solved by Kaiser Aluminum working with a customer. Perhaps *you* have a mystery one of our engineers might help solve? He's ready to give you expert advice on any casting problem—including conversion from cast iron to aluminum, mold and die design, alloy selection, heat treatment, finishing, fluxing, metal transfer.

FULL ALLOY AVAILABILITIES. Kaiser Aluminum can supply you *fast* with a wide selection of casting alloys to suit any engineering requirement—from general purpose, low stressed alloys to alloys having good properties at elevated temperatures.

FOR PIG AND INGOT with a free sleuthing bonus, call your nearest Kaiser Aluminum sales office or any of the distributors listed on the opposite page. Or write to: Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, 300 Lakeside Drive, Oakland 12, California.

KAISER ALUMINUM*

THE BRIGHT STAR OF METALS

*Trademark Kaiser Aluminum & Chemical Corp.

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

FRACTURED?

Your Kaiser Aluminum ingot distributor is more than a nearby source for aluminum pig and ingot. He's ready to render specialized advice on anything from alloy selection to fabricating methods. And "Service" is his middle name!

CALL YOUR NEAREST

KAISER ALUMINUM*

INGOT DISTRIBUTOR:

BENTON HARBOR, MICHIGAN
Michigan Standard Alloys Sales Co., Inc.
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BUFFALO, NEW YORK
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HUMboldt 4050

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R. Lavin & Sons, Inc.
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CLEVELAND, OHIO
Alloys & Chemicals Mfg. Co., Inc.
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Alloys & Chemicals Mfg. Co., Inc.
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George Sall Metal Co., Inc.
Pioneer 3-2828

WEST SPRINGFIELD, MASSACHUSETTS
New England Smelting Works, Inc.
REpublic 4-6491

*TRADEMARK KAISER ALUMINUM & CHEMICAL CORP.

Circle 605 on Page 53

Readers' Comment

Should Be Centigrade Scale

To THE EDITORS:

I read your article entitled "Aluminum Automotive Castings" in the March, 1960, issue of FOUNDRY magazine with much interest. However, I would like to call your attention to an error in Fig. 2 on page 88. The coefficient of thermal expansion values on your chart are per degree Centigrade and they are marked (°F).

H. R. DOSWELL
Vice President and Secretary
Permold Co.
Medina, Ohio

More on Hopewell Village

To THE EDITORS:

We appreciate the two copies of the July, 1959 issue of FOUNDRY. Had we known that the article "Early Iron Making Center Is Restored" was to appear, we would have suggested stress on several points which we think are of interest to your readers and of considerable importance to the village.

Hopewell Village invites foundrymen and molders to visit this historic site because an 1816-1844 cast house will be restored in the next several years. Retired foundrymen and molders, especially those whose fathers and grandfathers followed the trade, can furnish the park service valuable information.

Hopewell furnace employed 16 molders in the late 1830s, and made as many as 5000 stoves annually.

The cupola was operated for a short time in 1817, drawing experienced men from Malin's Valley Forge Works. We possess several blast books showing exact annual stove production per molder. The pay was from $8 to $12 per ton, evidently based on the difficulty in making the mold.

After 1844, stove production was stopped and records show that Buckwalter (of Sheeler-Buckwalter Stove Co., Royersford, Pa.) bought some Hopewell patterns and follow boards, while the Chester County Isabella furnace, operating into the 1890s, bought the flasks. Probably the Prizer Painter Stove Works,

Reading, the Posey Iron Works, Lancaster, and Buckwalters hired the Hopewell molders after 1844.

EARL J. HEYDINGER
Historian, Park
Hopewell Village National Historic Site
Elverson, Pa.

Student Days at AFS Exhibit

To THE EDITORS:

Leaders in the foundry industry are becoming increasingly aware of the strong role to be played by competent engineers in the foundry of tomorrow. Believing the forthcoming AFS Foundry Show can be a ready-made showcase for our industry, the first ever "Students to Convention" Committee has been formed under my chairmanship to promote "Students Days" at the Foundry Show.

Operating under the AFS Education Division, the committee is working with each of the 48 AFS chapters in North America toward having every chapter sponsor student engineers from schools in their area to two days, Tuesday and Wednesday, May 10 and 11, at the Foundry Show.

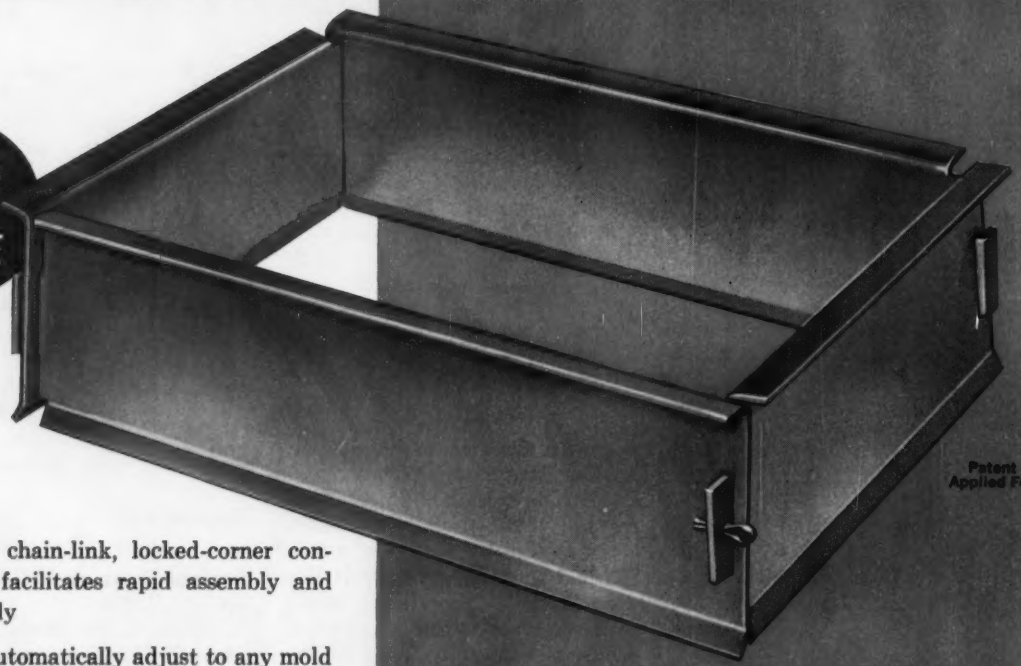
Meetings and plant tours designed especially for sponsored students, as well as the exhibits, will tell our story to the "best of class" of future engineers throughout the land.

E. G. GENTRY,
Chairman
"Students to Convention"
Committee
AFS Education Division
Penola Oil Co.
14300 *McNichols Rd. West*
Detroit 35, *Mich.*

Introducing

Ster-LINKED® POURING JACKETS

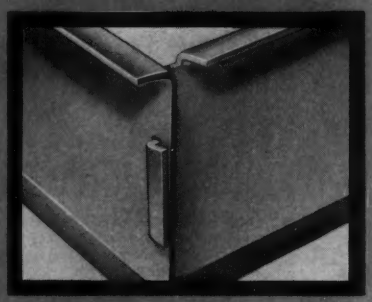
EASIER TO HANDLE



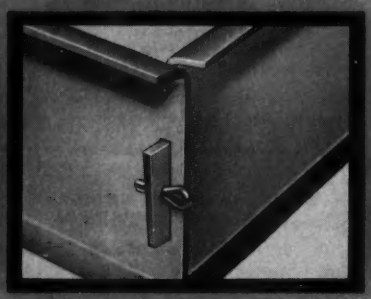
Patent Applied For

- Exclusive chain-link, locked-corner construction facilitates rapid assembly and disassembly
- Corners automatically adjust to any mold angle between 3° and 5°
- Entire steel jacket assembly locks at *one* corner with but *one* cotter
- Tapered, self-positioning lower flanges eliminate possibility of sand cut-ins
- Broad upper reinforcing flanges act as convenient lifting handles
- Knock-down construction minimizes shipping costs and conserves storage space
- Minimum assortment of side-and-end lengths can produce a variety of assembled jacket sizes
- Complete range of sides and ends, in various depths, available from stock

Circle 606 on Page 53



Three corners of every Ster-LINKED pouring jacket have quick-connect joints which operate on conveyor chain-link principle — rectangular mortises through which radiused tenons lock in all but one angular position. Thus each corner holds its side-and-end members securely during all handling, assembly, or disassembly operations — until it is deliberately unlocked by opening the joint to the position where the tenon can be withdrawn from the mortise.



With but one locking corner, Ster-LINKED pouring jackets are far easier to handle—maintain their assembled shape even when the locking corner is open. No members become disengaged during fitting or removal from the mold. No multiple locks are employed to make handling awkward. Lock is simple, yet positive. Single cotter holds straight tenon securely in locking-corner mortise — is easily replaced by any handy pin if misplaced or damaged.

AD-4845

Sterling WORLD WIDE SERVICE

STERLING NATIONAL INDUSTRIES, Inc.
Founded 1904 as Sterling Wheelbarrow Co.
Milwaukee 14, Wisconsin, U. S. A.

Associate: STERLING FOUNDRY SPECIALTIES LTD.
LONDON • BEDFORD • JARROW-on-TYNE, England

WHEREVER METALS ARE CAST ... FOUNDRY
APRIL 1960

Just Common Sense

There was a time when accidents in steel mills were almost as inevitable as death and taxes. Today the steel industry is one of the safest in the country; it has reduced its average accident frequency rate to 3 for each million manhours of work, and some plants have pushed their rate down to 1 or less.

Shortly after World War II there were only a few industries in which an individual was more likely to sustain a lost-time accident than by working in a foundry. The accident rate for foundries was twice the average for all industry and four times that of the steel mills.

Since then the foundry record has improved more rapidly than has the all-industry average. No credit should be taken from those who have been responsible for the results attained, but the better performance today stems partly from the fact that there was so much room for improvement.

Reduction in foundry accidents since 1945 has tended to level off in recent years, and the frequency rate of about 20 still is far too high. Seemingly the industry has eliminated the obvious hazards, but among only certain companies has a concentrated effort been exerted to remove the more infrequent and difficult to control accident causes. That is the tough job, but it is one that the steel industry has shown can be accomplished.

There's plenty of evidence to prove that a foundry can be accident-free. At the recent annual meeting of the Steel Founders' Society of America, seven steel foundries were honored for having had no lost-time accidents in 1959. The Cleveland sand foundry of the Aluminum Co. of America has neared 1½ million manhours of work without an accident. In that period the average foundry would have lost—at least temporarily—30 or more workers through injuries.

It is recognized that a successful safety program must be based on the enthusiastic support of management. Too often, however, management is wholeheartedly in favor of safety measures but fails to stimulate the necessary enthusiasm among those on the lower management level who must carry out the program.

The fact that the larger manufacturers, such as steel mills and automakers, can boast of outstanding safety records is neither a coincidence nor mere paternalism. Aside from humanistic considerations, it is a recognition that accident elimination pays off in higher worker morale, improved production, better product quality, and lower compensation costs—in other words, a common-sense business undertaking.

For cost-conscious foundries in these days when cost reductions come hard, their safety records should be a subject of major concern.

William G. Reese

Managing Editor

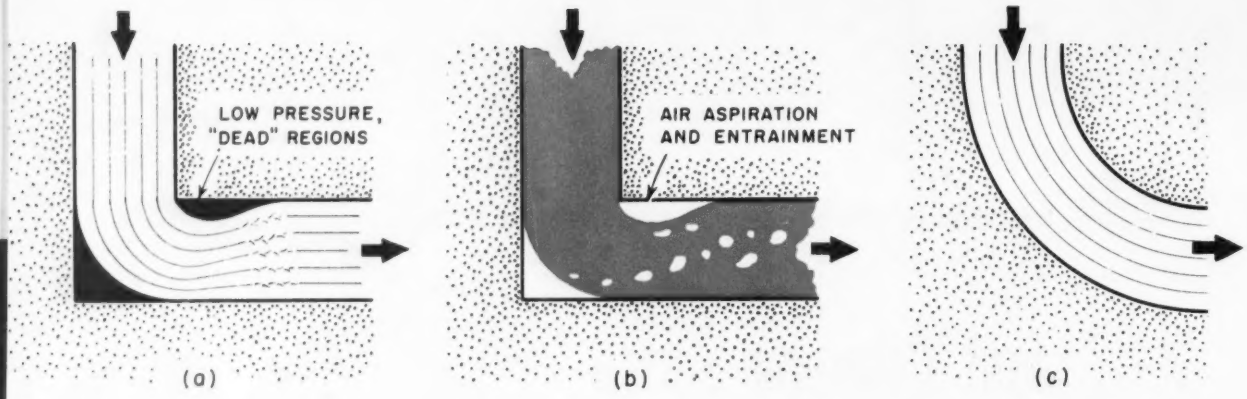


Fig. 1—Fluid flow around bends in a gating system:[3] (a) Turbulence resulting from a sharp corner. (b) Metal damage occurring at the corner. (c) Streamlining the corner

GATING . . . Aluminum Castings

This article, seventh in our gating and risering series, discusses the objectives of an ideal gating system for aluminum castings and explains how to design gating to achieve these goals

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Massachusetts Institute of Technology
Cambridge, Mass.

● THE FUNCTIONS of an ideal gating system for aluminum castings are to (1) fill the mold cavity, (2) introduce molten metal into the mold with as little turbulence as possible to minimize absorption of gases, dross formation, and mold erosion, (3) introduce proper skimming action on the metal as it flows through the gating system, (4) regulate rate of entry of metal into the mold cavity, (5) establish the best possible temperature gradients in the casting, and (6) produce a casting with minimum excess metal in gates and risers.

To accomplish the above objectives is not an easy task, and careful design of the gating system is essential. Most aluminum foundries find they can no longer afford the expensive luxury of permitting molders to decide upon their own gates, sprues, and runners. Today, gating systems are often designed by an engineer working with a skilled molder and patternmaker, or by a gating and risering committee.

In any case, many modern foundries follow the practice of designing and testing their gating systems on one or more pilot castings, and then mounting the gates and runners directly on the pattern equipment before a production run is started.

The advantages of careful gating design are most apparent in foundries producing castings of aircraft quality. Here, it is practically impossible to produce castings to the specifications demanded unless the castings are gated by someone with a real engineering (and often an intuitive) "feel" for the principles of fluid flow, and with an understanding of how these principles apply in practice. Even in foundries producing aluminum to less rigid specifications, sound gating design is an economical consideration. Improved gating design can increase

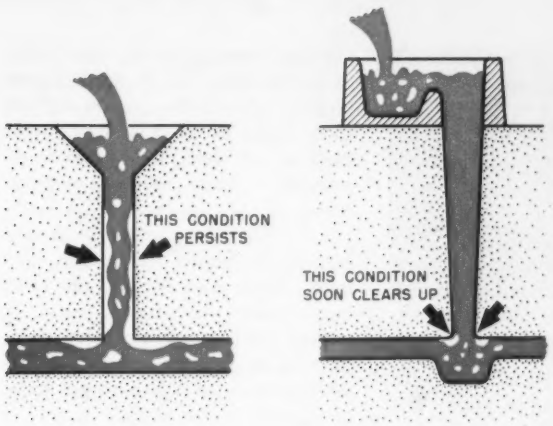


Fig. 2—Effect of sprue design on metal turbulence[3]

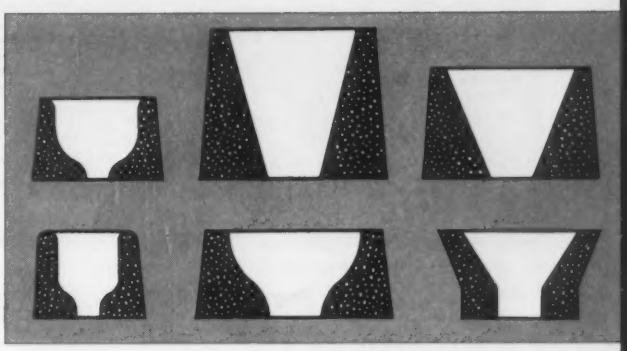


Fig. 3—Some typical pouring cup designs.[3] Pouring cups usually are suitable for high-quality castings

casting yield and can lower rejects even when the only inspection employed is visual examination.

General principles of gating have been discussed in an earlier article of this series[1] and in a recent comprehensive survey;[2] it is our purpose here to deal primarily with the application of these principles in production of sound, high-quality aluminum castings.

The Gating System

Perhaps the most important single factor influencing gating design is metal turbulence. If turbulence is excessive, aspiration of air and formation of dross result. Fig. 1 and 2 illustrate some examples of how this "metal damage" results from improper gating design; sharp corners (or sharp changes in channel cross section) are undesirable, as are untapered sprues.

Metal damage can occur within the gating system as shown in Fig. 1 and 2; it can also occur before the metal enters the gating system (through faulty pouring); or it can occur after the metal leaves the gating system (if it spurts or tumbles excessively into the mold cavity).

In general, turbulence is minimized and clean castings assured by (1) careful pouring, (2) streamlined gating systems, (3) use of a gating ratio such that the metal enters the mold at a low velocity, and (4) gating so the metal does not drop too great a distance in the mold cavity.

Pouring, Pouring Cups and Basins—Gating design for quality aluminum castings begins with the pouring cup or pouring basin. The cup or basin must be large enough and must be placed closely enough to the flask edge so the pourer can fill it quickly, keep it full during the entire pouring operation, and keep the ladle lip at all times close to the pouring cup or basin. Improper pouring, whether the fault of the operator or of the pouring box design, is often the source of defective castings.

Fig. 3 shows some typical pouring cup designs; these cups may be prefabricated and placed on the cope of the mold before pouring, or may be cut or formed into the cope half of the mold. Pouring cups usually are suitable for producing high-quality castings although pouring basins (Fig. 4) always are more desirable, especially when pouring is by a relatively unskilled operator. One distinct advantage of pouring basins is that the dam in front of the sprue hole permits the operator to reach optimum pouring speed before any metal enters the sprue.

Sprue Design—In aluminum alloys it is essential that sprues be tapered to avoid aspiration of air and metal damage (Fig. 2). Severe aspiration occurs in sprues of uniform cross section; the aspiration results because metal velocity increases as it descends the vertical sprue. If the sprue is tapered by an amount sufficient to assure that the metal lies firmly against the mold, aspiration and turbulence are minimized.

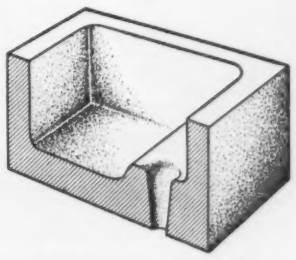


Fig. 4—Typical pouring basin[3]

The amount of taper necessary to avoid metal damage in a sprue depends on sprue height, pouring basin height, and sprue size. The necessary taper can be calculated from the equation:

$$A_1/A_2 = \sqrt{Z_2/Z_1}$$

where

A_1 = area of the sprue entrance

A_2 = area at any other location in the sprue

Z_2 = distance from top of the pouring basin to the location of A_2

Z_1 = level of the pouring basin above the sprue entrance.

This equation indicates that the ideal sprue should have a parabolic taper, but in practice it is sufficient to calculate the inlet and outlet areas from the equation and draw a straight-sided taper between them (Fig. 5).

As an example of the use of the equation to calculate sprue size, consider a sprue of square cross section at the base, ½ x ½ in. (0.25 sq in.). If sprue height is to be 4 in. and if a 3-in.-deep pouring basin is employed (and kept full during pouring), then:

TABLE I—Sprue Designs for Nonferrous Castings

(For sprues of square cross section, with a 3-in.-deep pouring basin. Cross section of sprue entrance is given for various sprue sizes and sprue heights)

Sprue Size at Base (Inches square)	Sprue Height in Inches				
	4	6	8	12	18
1/2	5/8	21/32	11/16	3/4	25/32
5/8	25/32	27/32	29/32	15/16	1
3/4	15/16	1	1 1/32	1 1/8	1 3/16
1	1 1/4	1 5/16	1 13/32	1 1/2	1 9/16

Example: If required sprue height is 4 in. and size of the sprue base is chosen to be ½ x ½ in. square, size of the sprue entrance should be about ⅝ x ⅝ in. to avoid turbulence. If the pouring basin is deeper than 3 in., less taper is required.

$$A_1 = 0.25 \sqrt{(4 + 3) \div 3}$$

and $A_1 = 0.38$ sq in.

Thus the entrance area of the sprue should be 0.38 sq in.; if the cross section is to be square, the sprue entrance will be approximately ⅝ x ⅝ in.

The equation does not allow for entrance or exit effects; in practice the sprue entrance should be generously radiused (this can be accomplished readily by incorporating a radius in the pouring basin), (Fig. 4). In other respects the taper calculated from the equation probably is somewhat conservative, since energy losses in the sprue and beyond create a back pressure which reduces the amount of taper necessary. Sometimes the frictional energy loss in the sprue is increased intentionally by use of rectangular cross-section or "slot" - shaped sprues; when this is done the amount of taper necessary is much less than that calculated above.

Because of friction losses and because a sprue taper that is somewhat larger than calculated above cannot harm metal quality, the equation need not be followed rigorously each time a new casting is rigged. In each shop a few standard sprue tapers and pouring basins usually suffice for at least the majority of jobs encountered. Nonetheless, it is wise to adhere as closely as possible to the tapering recommended above, and to this end some shops have prepared a table such as the one shown in Table I to simplify the task of sprue design for individual jobs.

Table I, which applies only when a 3-in.-deep pouring basin is employed, shows the amount of tapering necessary for various sprue sizes and sprue heights. The table is compiled for sprues of square cross section; square sprues are used more widely today than sprues of circular cross section, primarily because of ease of fabrication.

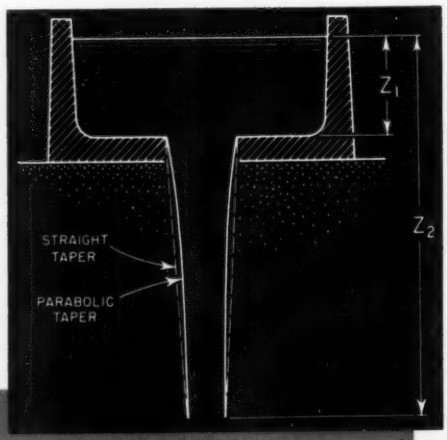
Sprue size (cross-sectional area at the base) should be chosen with several considerations in mind: The sprue must be small enough so that (1) the pouring operator can keep it full (choked) during the entire pouring operation, and (2) metal does not enter the mold cavity with such high velocity that splattering and turbulence occur.

At the same time, the sprue must be large enough so that (1) the casting fills completely without laps, seams, or misruns, and (2) a metal head is built up quickly enough to prevent mold gases from being aspirated into the metal.

As examples of sprue sizes and pouring times employed, small castings (less than 25 lb total poured weight) should be poured in less than about 20 seconds and larger castings in less than about 45 seconds. This usually requires sprues of ½ x ½ in. or ⅝ x ⅝ in. (at the base) for smaller work and ¾ x ¾ in. sprues for heavier castings. Since most pouring operators have trouble keeping sprues fully choked which are larger than about ¾ x ¾ in., sprues larger than this seldom are used. If a single sprue of ¾ x ¾ in. (or slightly larger) is not adequate to fill a large casting in the required time, two or more sprues and more than one ladle may be used.

One additional item of sprue design is the "sprue button" or "sprue well." At the juncture between the sprue base and runner some streamlining is desirable to minimize the turbulence which invariably occurs when metal must change direction sharply. Radiusing, such as illustrated in Fig. 1, usually is difficult to incorporate at the sprue base; in-

Fig. 5—In theory, sprues should have parabolic tapers, but straight-sided tapers will suffice



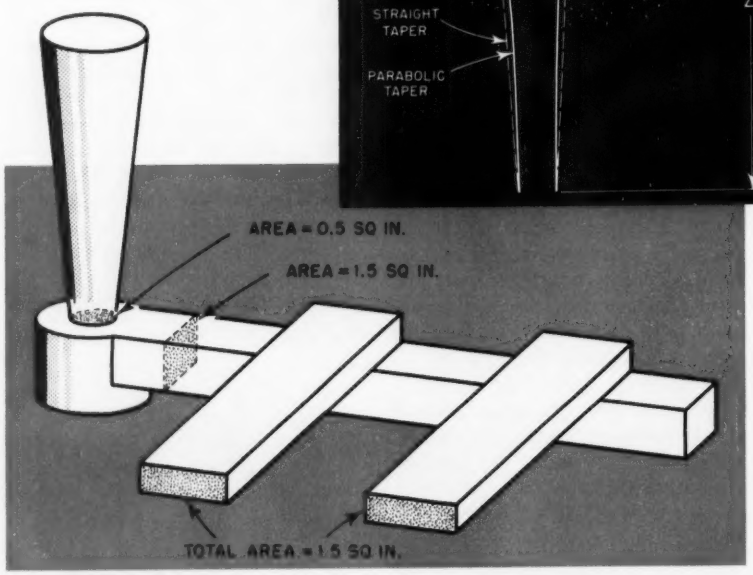


Fig. 6—An unpressurized gating system. The gating ratio of this system is 1:3:3.[3] Sprue is tapered but little else is streamlined

stead, the base often is enlarged. This enlargement, shown in Fig. 2, serves to cushion the falling metal and absorb its kinetic energy. It is usual practice to make the diameter of the sprue well 1½ times the runner width and to make its depth 1½ times the runner depth.

Gating Ratio and Runner System—"Gating ratio" is the term used to describe the relative cross-sectional areas of the components of a gating system. It is defined as the ratio of sprue area to total runner area to total gate area. For example, a gating system which has a sprue of 1 sq in. cross section, a runner of 2 sq in., and two gates each of 1 sq in. cross section, has a gating ratio of 1:2:2.

Gating ratios recommended in the literature for foundry use vary over a wide range, but they may be grouped into two general classifications—pressurized and unpressurized systems.

In the pressurized system the arrangement is such that a back pressure is maintained on the gating system by a fluid-flow restriction at the gates; this usually requires that the total gate area be not greater than the area of the sprue, as for example in systems with gating ratios of 1:0.75:0.5 or 1:2:1.

In unpressurized systems, the primary restriction to fluid flow is at or very near the sprue; gating ratios such as 1:3:3 are used for this type system.

Unpressurized gating systems are used almost exclusively in producing high-quality aluminum castings. Their advantage lies in the fact that the relatively large runner and gate areas slow down metal flow, minimizing turbulence in the gating system and reducing "spurting" (and hence turbulence) as the metal enters the mold cavity. Gating ratios between about 1:2:2 and 1:6:6 are employed commercially; usual preference is for systems of the order of 1:3:3.

Fig. 6 illustrates one such gating system; the runner is in the drag and gates are in the cope to assure that the runner is kept full during pouring. Fig. 7 shows a fully streamlined gating system, with runner cross section reduced at each gate and with gentle tapering placed at each gate exit.

Streamlining of runners and gates as shown in Fig. 7 is desirable because (1) energy losses in the system are lowered so runners and gates can be smaller and still pass metal at the required rate, and (2) turbulence in the system is lowered which reduces chances of metal damage by absorption of air and drossing. The first of these considerations means that streamlining can increase yield by reducing the amount of metal left in the gating system; if large numbers of castings are to be made from a single pattern, streamlining may be important chiefly from the standpoint of improved yield.

In spite of the foregoing, complete streamlining of gates and runners seldom is employed in aluminum jobbing foundries today; rather, a typical gating system for a high-quality casting often appears more like the one shown in Fig. 6. The sprue is tapered but little else is streamlined. This is because (1) yield often is not of great importance when only a relatively few castings are to be produced, and (2) practice over the last few years has shown that sound, high-quality castings can be produced without streamlining runners or gates.

It appears that the low metal velocities in runners and gates (when gating ratios such as 1:3:3 are employed) permit considerable deviation from ideal practice before damage to the metal results; this situation is quite the reverse of the case in sprue design, where failure to provide adequate taper almost al-

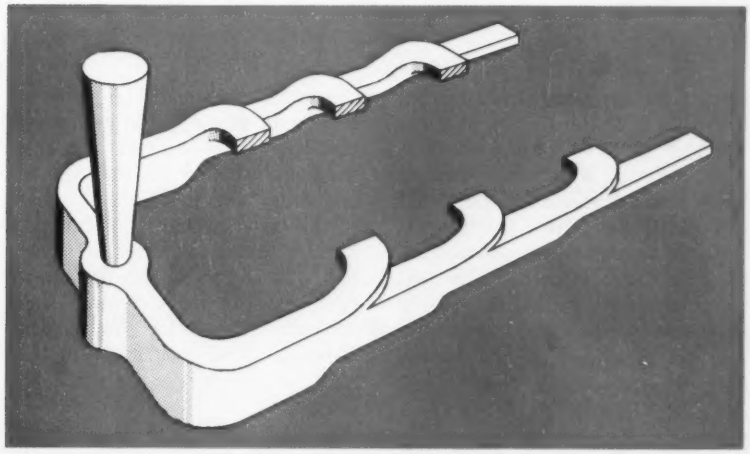


Fig. 7—This fully streamlined gating system (after Grube and Eastwood) includes reduced runner cross section at each gate[8]

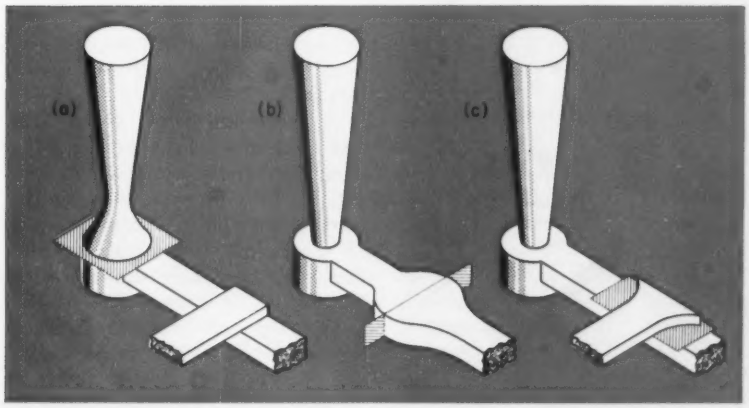


Fig. 8—Possible methods of inserting screens in a gating system[3]

ways results in dross and entrapped air.

It should be noted here that sometimes there is another reason for streamlining runner systems (including reducing runner size at each gate) as shown in Fig. 7. In systems that are not streamlined, the kinetic energy of metal flowing in the runner tends to carry it down the length of the runner and out the gates farthest from the sprue. Careful design, including reduction of runner size after each gate, can be used to obtain nearly uniform flow through all gates (although some trial and error usually is necessary to arrive at proper gating ratios).

Dross Removal in the Gating System — For one or another reason even the most carefully designed gating systems may have dross or air entrapped in the metal flowing through it. These foreign materials can originate in the melting furnace or the ladle and be carried into the gating system. They can arise from faulty pouring, or they can be produced in the gating system itself. Especially in the early stages of pouring when the runner system is not completely full, some air entrapment and dross formation probably are inevitable.

To prevent foreign materials in the flowing stream from reaching the casting, various steps often are taken to "clean" the metal as it passes through the runner system. One of the most common measures is extension of the runner past the last gate (Fig. 6). Since the first metal through a runner system is likely to be damaged by the initial turbulence, the runner extension is intended to prevent this metal from reaching the mold cavity. The first metal tends to be carried by its kinetic energy past the ingates and into the "dead end" of the runner; only the subsequent clean metal enters the casting.

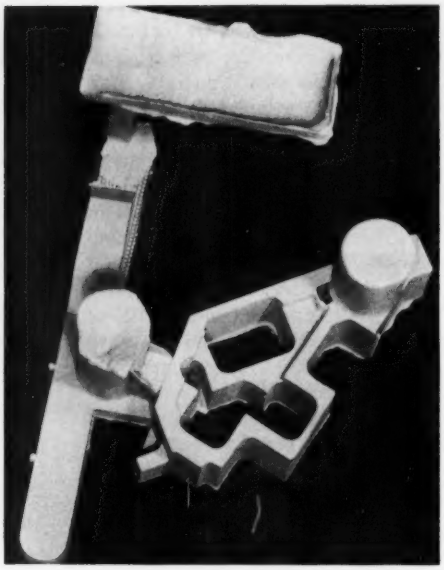


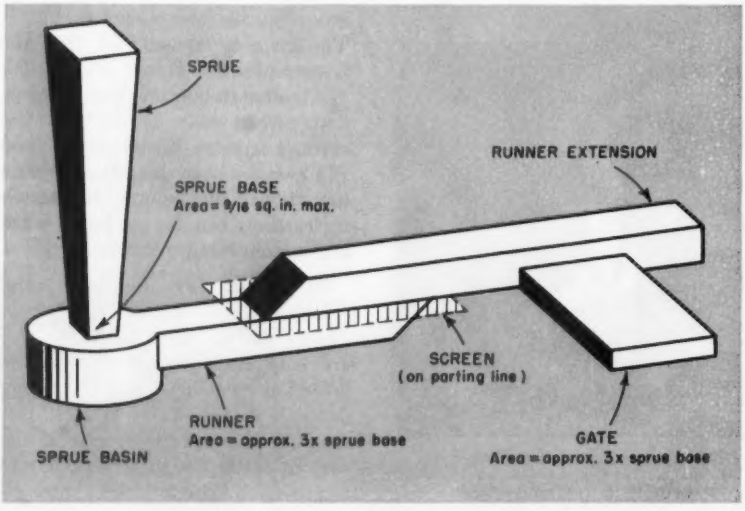
Fig. 10—Riser gated casting. Sprue size is ⅜ x ⅜ in. at base. Casting weight is approximately 5 lb (including rigging)

Another technique for cleaning aluminum alloys in the gating system is to make runners and gates wide and shallow so that the air and dross tend to float and adhere to the cope surface. For complete metal cleaning, however, it is necessary to add screens to the runner system; perforated tin-plated sheet normally is used for this purpose, although other materials such as mica or refractory screens also are suitable.

Screens are inserted in gating systems at various positions—at the sprue base, in the runner or gates, or at the junction between runner and gates. Fig. 8 illustrates several possible arrangements. Wherever screens are located, it is usually desirable to enlarge the cross section of flow channel at that point; otherwise the screen will act as a "choke."

A screen and gating system that has proved excellent at the MIT Foundry Laboratory is sketched in Fig. 9. Here the runner crosses the parting line and the screen is placed in the parting line across the runner. It is probable that the cope portion of the runner does not fill completely until late in the pouring operation; however, the portion of the runner behind the screen is choked rapidly (and turbulence in this part of the gating system is minimized quickly) in the initial

Fig. 9—Method of placing screens in a gating system used at MIT for producing prototype aluminum castings for missile guidance systems[3]



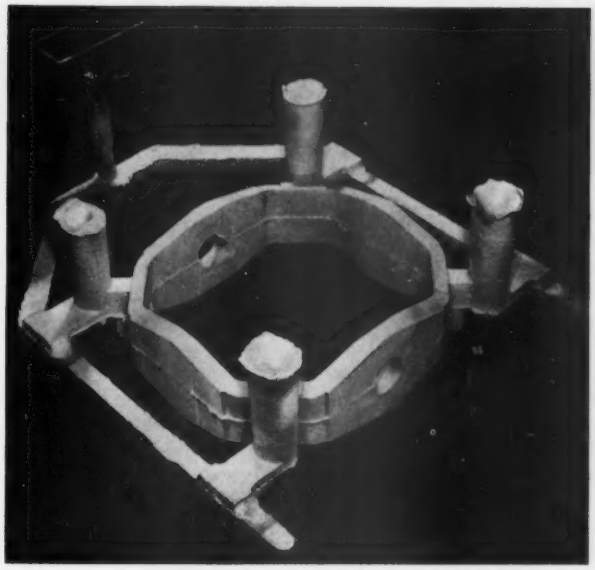


Fig. 11—Typical riser gated casting. Sprue size is ¾ x ¾ in. at the base, and casting weight is approximately 35 lb (including rigging)

Fig. 12—This is a riser gated (and bottom gated) casting. Sprue size is ¾ x ⅞ in. at the base. Casting weight is about 110 lb (including rigging)

phases of pouring the casting.

The so-called "drag to cope" gating system shown in Fig. 9 is one used almost exclusively at MIT for producing prototype aluminum castings for missile guidance systems. A similar arrangement frequently is used for casting magnesium alloys. In the case of magnesium the overlap of the cope and drag runner (screen area) is extended so the screen covers nearly the entire length of the runner.

Gates and the Casting

In the rigging of actual castings, sprue design usually is determined first, on the basis of casting weight and section thickness. Runner area and total gate area then are determined. The actual number, shape, and location of gates used depends on the shape and complexity of the casting being rigged. In general, gate design and location are influenced by considerations of (1) optimum feeding, (2) minimum turbulence during filling of the mold cavity, and (3) faithful reproduction of the mold cavity in a manner to prevent misruns and provide good surface finish.

Gating and Feeding—Gating and risering are closely interdependent processes. The size, shape, and location of gates often are dictated by the method of risering; conversely, risers should not be chosen without consideration of the method of gating. For most types of aluminum castings, riser gating is desirable and is practiced whenever possible.

Fig. 10, 11, and 12 illustrate typical examples of riser gated castings. In each case, metal does not enter the casting directly but passes first through side risers.

There are several advantages in this type of gating. The last (and hottest) metal ends up in the riser, where it belongs for optimum directional solidification. Hot metal passing over the riser base and through the riser neck heats up the sand in these areas, thus promoting directional solidification. Still another advantage is that removal of gates does not require an extra cleaning operation (they are removed when the risers are cut away).

On complex castings it is not always possible to have all gates enter through risers and in these cases numerous gates should be employed and the gates should be of thin cross section so they freeze quickly. Both precautions are taken to prevent shrinkage or dishing at the gate entrances due to formation of hot spots.

"Cold metal" risers (risers not joined directly to a gate) usually must be somewhat larger than hot metal risers if they are to feed properly. In some cases, extreme difficulty is experienced in making cold metal risers feed intricate castings adequately; in these cases, "hot topping" sometimes is employed.

The simplest (and least satisfactory) method of hot topping is to pour hot metal directly down the risers. Late in the pouring operation, as risers are beginning to fill the gating system, an additional ladle is used to pour metal directly into the risers. This technique promotes directional solidification but its disadvantage is that dross and air easily are entrapped and carried into the casting.

A modified hot topping practice which is currently in favor gives much better results in producing castings of high quality. In this case, a three-part flask is used with two separate gating systems. Runners and gates of one system are at the lower parting line and feed directly to the casting. Runners and gates of the other system are at the upper parting line and feed directly to the risers (top risers or side risers). The casting then is poured from the first gating system and risers are topped by delayed pouring through the second system.

Gating for Minimum Turbulence—Except for pouring metal directly

down risers, gating at the parting line usually is the most economical technique for producing sand castings. Parting line gating is used widely in aluminum foundries, both because it is relatively inexpensive and because, in most cases, this type of system can produce sound castings which are free of defects caused by gating.

The main disadvantage of parting line gating is that care must be taken to prevent metal spurting into the mold or cascading too far down into a drag cavity; otherwise, turbulence and metal damage can result. To minimize these dangers, several practices are followed. An unpressurized gating system is used (as, for example, one with a gating ratio of 1:3:3) so the metal enters the mold cavity slowly and "slides" down the mold walls to the bottom of the drag cavity. Patterns usually are designed so that long dimensions are cast in a horizontal plane; also, the deeper section usually is molded in the cope. Both procedures reduce the depth through which the molten metal must drop.

It is always wise to exercise strict precautions to reduce metal turbulence in a mold cavity (particularly for severely drossing alloys such as 214 and 220); nonetheless, when unpressurized gating systems are employed, many aluminum alloys can be dropped 10 in. or more in a mold cavity without suffering perceptible damage. When drops greater than this cannot be avoided, bottom gating should be used.

Reverse horn gates can be employed for this purpose or, better, the casting can be molded in a cheek with runner in the parting line below; the gating system then is much like that of Fig. 6 or 7 except that gates go vertically upward from the runner to the casting. Fig. 12 illustrates a typical bottom gated aluminum casting.

Gating and Running—A major problem in the gating of aluminum castings often is that of fluidity—i.e. completely filling the mold cavity. Sometimes lack of fluidity is caused by back pressure from mold gases. When this is the case, the remedy usually lies in adequate venting, increasing sand permeability, or reducing the content of volatile materials in the mold or core sand.

When back pressure is not the cause of misrun castings, fluidity usually can be improved considerably by changing metal variables or gating techniques. Increasing superheat or changing to a more "fluid" alloy are two courses of action; effect of temperature on the fluidity of several commercial alloys is shown in Fig. 13. Fluidity also can be improved by increasing the rate of flow of hot metal to thin sections; this is done by (1) increasing sprue height, (2) increasing sprue size, (3) decreasing gating ratio, or (4) gating directly into thin section locations, with multiple gates or with long "knife gates."

Still another method for improving fluidity in castings is to employ one or another of the mold coatings developed recently for this purpose. Fig. 14 shows how a mold coating of hexachloroethane permitted filling of a thin plate casting while a second uncoated plate (on the same runner) filled only partially. Use of this coating has been shown to permit reductions of several hundred degrees in pouring temperatures needed to completely run prototype castings.

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ACKNOWLEDGMENT

Illustrations courtesy of George E. Schmidt Jr., Massachusetts Institute of Technology, and John Wiley & Sons, Inc., New York.

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Fig. 13—Effect of pouring temperature on the fluidity of several commercial alloys[4]

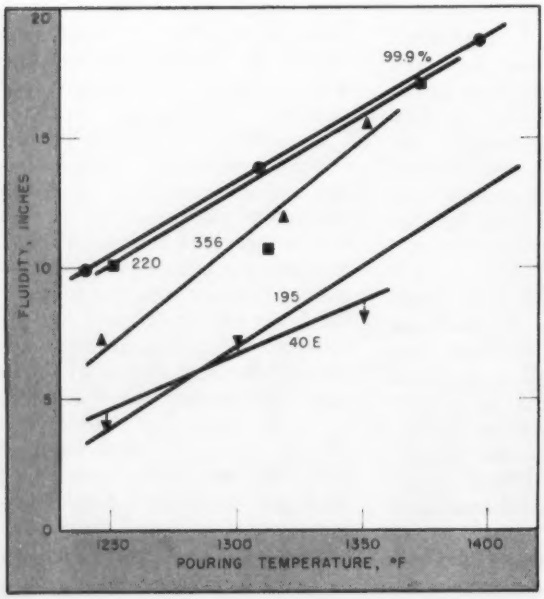


Fig. 14—Effect of a mold coating of hexachloroethane on plate casting fluidity[4]

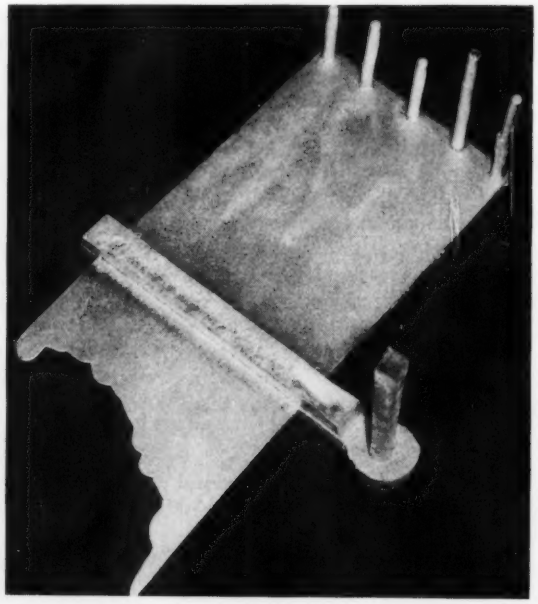


Fig. 1—At the prime station, all castings are sprayed with a vinyl base coat, and those castings requiring a water test are set off the line and filled with water

WHY PAINT CASTINGS?

Painting of castings prevents rusting and contamination, highlights surface irregularities which can be corrected by touching up, and creates general recognition that castings are high-quality products

By ROBERT H. HERRMANN
Associate Editor

● FOUNDRY Division of the Cincinnati Milling Machine Co., Cincinnati, paints or primes all of the gray iron castings it produces. These castings are used principally in the building of machine tools.

The purpose of the painting operation is to prevent rusting and contamination of casting surfaces and to provide a base for the final finishing of the completed machine. Painting also tends to highlight surface irregularities which may be corrected by additional touch-up. An advantage is realized in painting castings in the foundry because adhesion between paint and casting will be at a maximum since the surface of the casting is free of dirt and oil. Foundry production departments thus have added incentive to provide good casting surfaces along with other quality considerations.

The psychological effect on machining operators and machine assemblers is an indirect benefit. Painted castings are recognized as a high-quality product and are handled as such.

Casting Preparation — Prior to painting, the Cincinnati Milling Machine Co. Foundry processes all castings through grit blast, chipping, and hand grinding operations. Particular attention is given to casting detail with respect to the blending of radii and fillets, the sharpness of unmachined contours and lines, and preparation of the external surface that will ultimately require filling and sanding.

Castings having reservoirs for lubricating oil, hydraulic oil, and coolants must be water tested to preclude the possibility of leaks. This is a nonpressure test wherein water, treated with a rust inhibitor, is poured into the reservoir and allowed to remain for several hours. Leaks are observed as rust spots on

Fig. 2—Rough casting surfaces are knife coated, hot sprayed with pigmented proxylin filler, and sent through a filler coat drying cycle

external surfaces of the castings.

Painting Large Castings—Painting is performed on three separate roller conveyor lines, each handling the output of one of three casting divisions. The sequence of operations on the large and medium casting lines is similar and is covered by the following description of the large casting line. Individual castings are set on wooden pallets for movement on a roller conveyor to the prime station, Fig. 1. All castings are sprayed with a vinyl base coat, and those castings requiring a water test are set off the line and the reservoirs filled with water.

The primer is a fast drying material and when dried all obvious low spots, pin holes, and similar casting surface defects are filled with a nonshrink patching plaster. This entire area is above a grate-covered pit. Paint overspray is drawn through the grating into the pit, through paint eliminators and into an exhaust tunnel. Other paint spray stations are similarly arranged.

Pallets and castings are moved along the conveyor to a drying oven where a pneumatically operated ram with pusher dogs moves the pallets through the oven to dry the prime coat and the patching plaster. Steam heated air at 200° F is circulated through the oven to effect the drying. The castings next

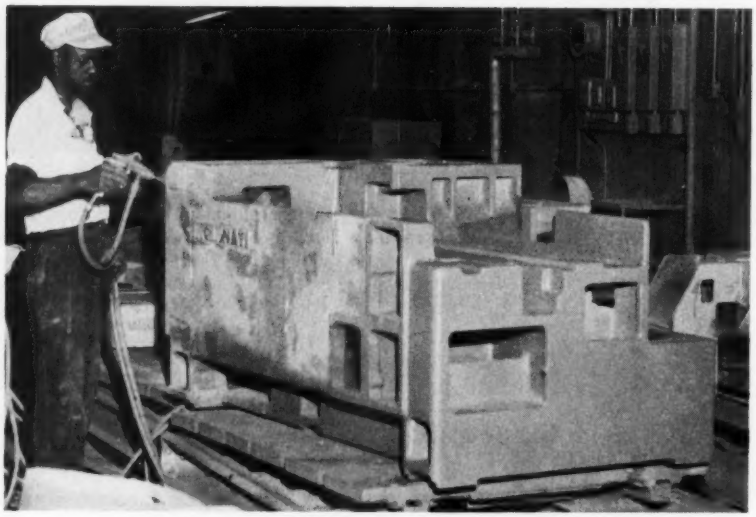
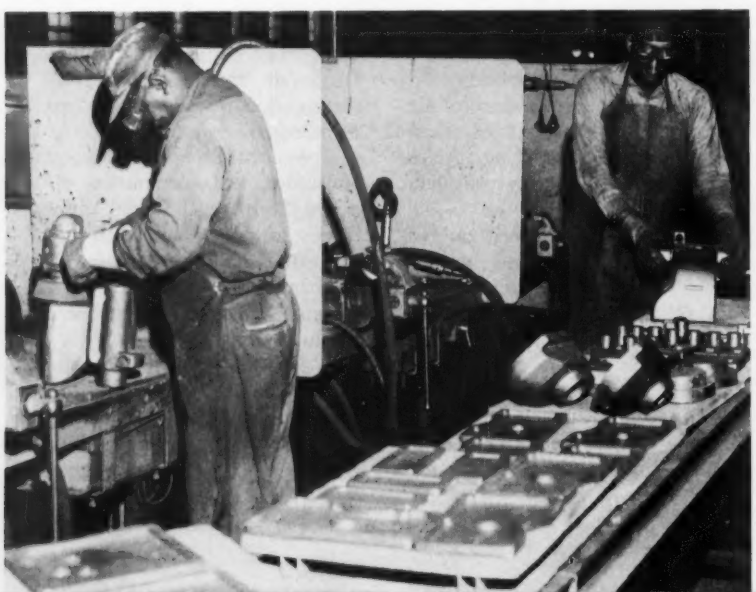


Fig. 3—At the final color station, sanded castings receive a last interior and exterior coat of paint. Castings then are inspected

Fig. 4—After completion of grinding with portable tools, the cleaned castings are placed on pallets and moved manually to the prime station



are moved to an open side exhaust hood where rough casting surfaces are knife coated and hot sprayed with a pigmented pyroxylin filler, Fig. 2. A drying cycle for the filler coat follows, and the castings are ready for the sanding operation.

As a guide to effective sanding, a light coat of orange calcimine is sprayed on the castings to show up low spots. Sanding is done manually and with vibrating sanders. Final touch-up of low spots and other surface irregularities, as indicated by the orange guide coat, is done and the castings are moved to the final color station, Fig. 3. Here the finish coat of machine tool gray vinyl paint is sprayed on the exterior while a cream colored vinyl

Fig. 5—The finished castings are primed on a turntable conveyor section

sealer is used on the interior. The castings are given a final inspection, and as they are lifted by overhead crane for movement to the shipping floor or directly to flat cars, the bottoms are sprayed to complete the operation.

Painting Small Castings — Grit blasted castings are trucked to one of four, two-wheel snagging grinders arranged in pairs on either side of a waist-high roller conveyor. Between each pair of grinders and the conveyor is a bench divided into four compartments. Here eight operators snag fins and riser pads, placing the rough ground castings in the bench compartments behind them. Having worked up several lots of castings, the operators move to the bench, completing the grinding with portable tools, Fig. 4.

Finished castings are stacked on small pallets on the centrally located conveyor and manually moved down the line to a prime station, Fig. 5. Some of these castings receive only a prime coat and move directly to the shipping floor by suitable roller conveyor. Those requiring the complete operation are pushed through a drying oven by dogs on a chain drive. Castings emerge from the oven to a gravity roller conveyor. Here they are sprayed with hot pyroxylin filler and enter another oven to dry the filler coat. After sanding, Fig. 6, the final color coat of machine tool gray vinyl paint is applied. Castings proceed on the roller conveyor to the shipping floor where casting lots are accumulated prior to shipment.

Although painting of castings in the foundry represents added cost, it provides a service to those customers whose final product requires painting. Advantages to the customer include the ability to store castings out of doors without subsequent grit blasting, improved appearance of castings during machining and assembly operations, and a reduction in time needed to prepare the finished product for painting.

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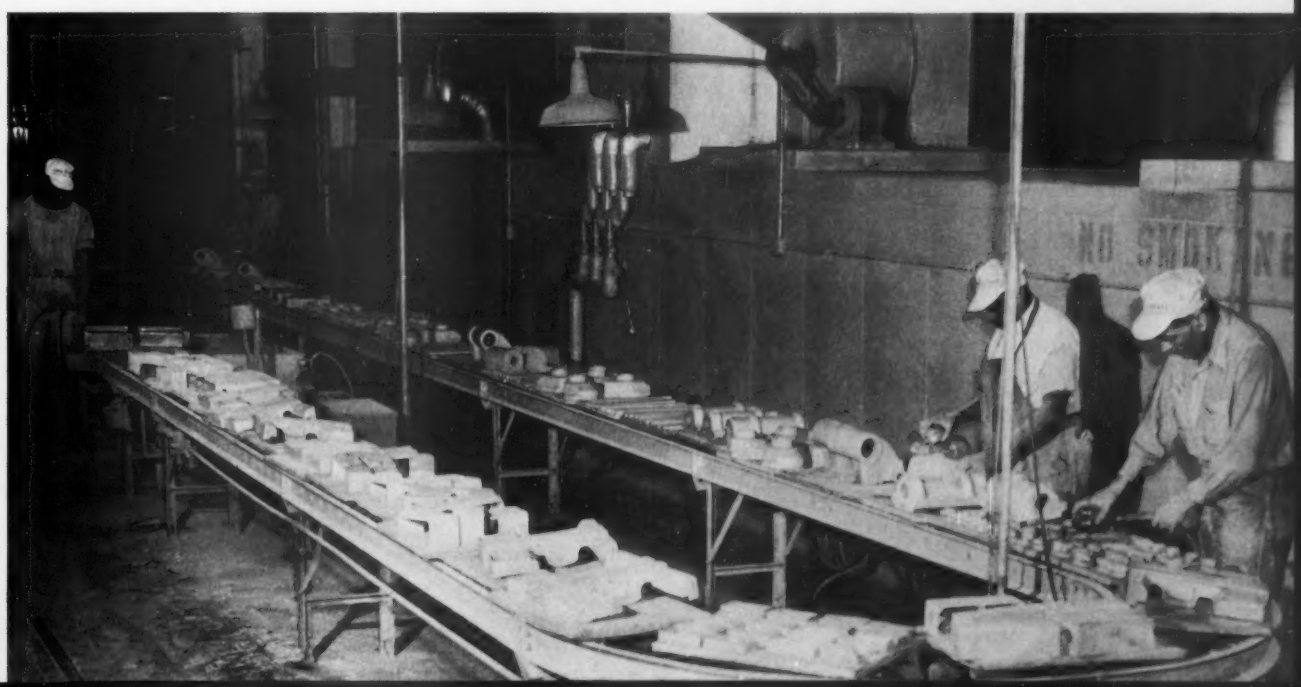
Fig. 6—Filled castings are sanded and receive the final color coat at this station



HIGH-QUALITY AIRCRAFT

Designing a jet trainer, Norair used alloy 17-4PH investment castings as prime structural components. Chief problems encountered were microshrinkage and the presence of dendritic delta ferrite. This article discusses these problems and how they can be avoided

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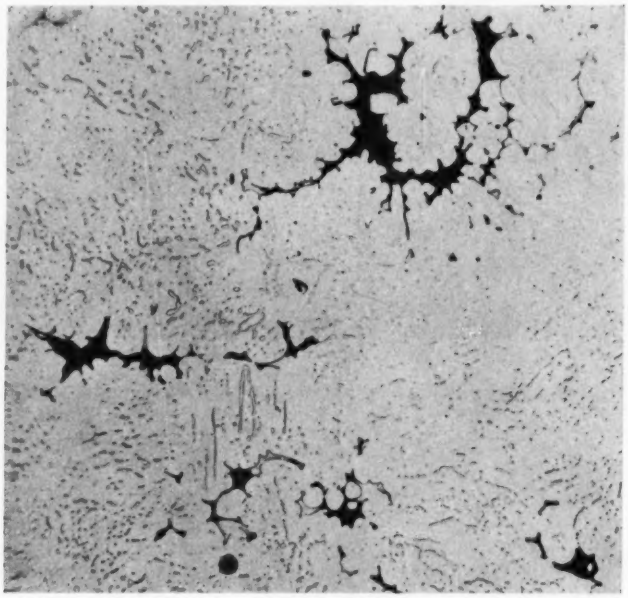

Fig. 1—Microshrinkage was one of most prevalent causes of poor ductility in cast 17-4PH steel. Elongation is less than 1 per cent. Magnification, X100

● IN THE DESIGN of the T-38 Talon supersonic jet trainer, Norair attempted to produce an airplane capable of century series fighter performance without their high cost and weight. Many design innovations were used, many of which were beyond the then existing "state of the art." Among these was the use of investment castings as prime structural components. Approximately 18 casting configurations are used of which a high percentage is critical with respect to pilot safety and the safe performance of the aircraft.

Alloy 17-4 PH—a chrome-nickel alloy—was chosen for these castings because of its good corrosion-resistance properties, high strength and ductility, and castability. The castings were produced to the Norair specification, which is to all intents and purposes identical to the AMS Specification 5355. Due to the apparent success foundries were having in producing castings of this alloy and its wide usage in the industry, no problems other than routine ones were expected.

During the normal inspection procedures utilized, it was discovered that some castings had failed to respond properly to heat treatment. The trouble was traced to carbon and nitrogen picked up in carbon arc melting, which was being used by one of the foundries. The foundry was advised of the trouble and was requested to change to induction melting; the result being that no further trouble of this type was encountered.

Inferior Ductility—The problem caused doubts about the integrity of castings which had been previously received and were being received. An investigation indicated that although the castings had adequate strength in all cases (with the above-mentioned exception), approximately 90 per cent of them had ductility far below the required 6 per cent minimum elongation. It was found in many cases that the tensile specimen fractured before a 0.2 per cent offset yield could be obtained. It was obvious that this condition could not be tolerated in structural applications.

An investigation into the causes for the problem brought out the fact that all castings (except for the aforementioned case) were well within the specified chemical composition ranges, and all were completely x-ray sound. The cause for the poor ductility was found in the metallographic analysis. The accompanying photomicrographs show typical microstructures encountered.

Fig. 1, indicating microshrinkage,

CASTINGS

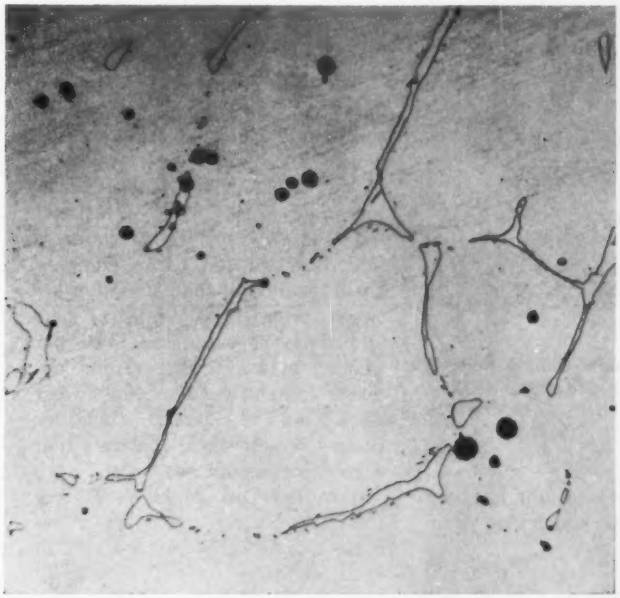

Fig. 2—Most troublesome condition encountered was delta ferrite in cast 17-4PH steel. Elongation is less than 1 per cent. Magnification, X500

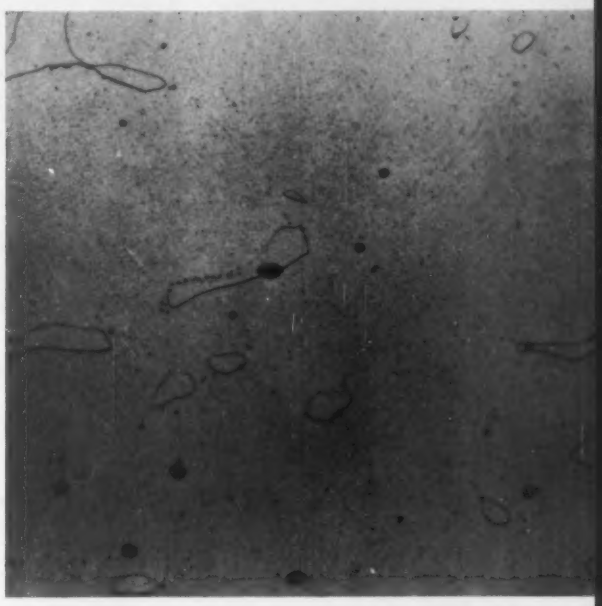

Fig. 3—Cast 17-4PH steel, an example of optimum microstructure, shows high strength and ductility. Elongation is 14 per cent. Magnification, X500

is an example of one of the most prevalent causes for poor ductility. Microshrinkage of this type was encountered especially in castings and test bars from a foundry utilizing a ceramic shell investment mold which was poured without preheating. The rapid cooling inherent in this process is believed to have been responsible for this condition. Microshrinkage was found in a few castings produced by other foundries not using shell investment molds, but these cases were rare and the causes could be attributed to poor gating practices.

Fig. 2 illustrates the most troublesome condition encountered. The dendritic delta ferrite shown here reduced ductility severely. In the study of many brittle fractures, the fracture path could be traced along the martensite-ferrite interface. This condition was found in castings produced by both shell and investment methods. However, it was more severe in the investment shell-produced castings. Elimination of this trouble posed the greatest problem.

Fig. 3 is shown for the sake of illustrating what is considered the optimum microstructure. This type of structure was found in castings exhibiting good ductility and strength.

A Foundry Problem—Solution to the problem of microshrinkage was strictly a foundry responsibility and was not considered as serious as the low ductility resulting from excessive or at least the dendritic structure delta ferrite. An R & D program was started and the problem investigated.

The trouble apparently stemmed from two causes, one being a fact seemingly overlooked in the past. This was the fact that even though the chemical composition was within the specification ranges, the resultant properties of the casting did not necessarily meet the required properties, especially the ductility. Although the chemical composition ranges are important, their control does not entirely solve the problem of low ductility.

The second problem that was uncovered during the R & D program was the effect varying cooling rates had on the ferrite formed in the castings. It was found that the shape and amount of ferrite could not be changed through normal heat treatment. Because of these conclusions it was evident that control of the ferrite formed was dependent on the cooling rate of the cast metal as well as the composition limits. Fig. 4 illustrates the dendritic pattern of the ferrite obtained during rapid cooling of the

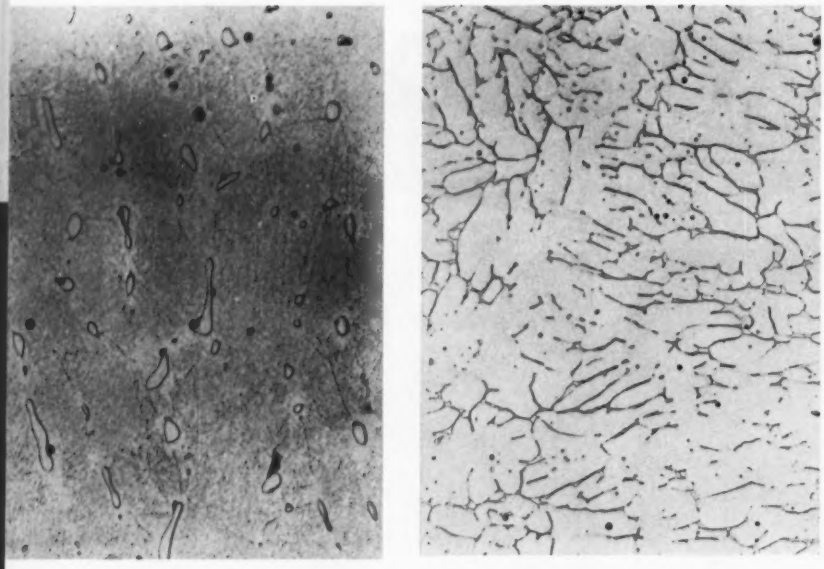

Fig. 4—Dendritic pattern of ferrite obtained during slow cooling (left) and rapid cooling (right) of cast 17-4PH steel. Magnification, X500

cast metal. The second half of the figure illustrated the well-dispersed globular type of ferrite resulting from slow furnace cooling of the cast metal.

Heat treatments were of no value in elimination or reshaping of the ferrite. It was found, however, that evidently some inhomogeneity existed in the cast structure (probably a segregation of copper on a submicroscopic scale). While it was invisible, it was necessary to homogenize the structure through heat treatment at 2100° F. Fig. 5 shows the effects of this homogenization. As a result of these data, a homogenization heat treatment has become mandatory for 17-4PH castings.

Close Control Mandatory—The aforementioned factors (although by no means the only factors governing the successful production of castings) point up the definite need for close control of every step throughout the casting process, including the production of remelt stock and final processing. This material is not unique in this respect, however. The increasing demands being made of materials in this age require that closer controls be imposed, particularly on castings. Castings have long been thought of as hardware items and their use as prime structural components is strange to the foundries. A great deal of re-education has been necessary to obtain the desired properties in the castings.

It has become necessary to devise means of assuring the user of castings that the properties of the casting meet his requirements. Seeming subtle differences in casting production make large differences in the final product. The only sure method of determining a casting's worth is by destructive testing of the casting—sure but extremely impractical. Hardness tests are of no value, x-rays disclose only gross defects, and chemical analyses are of little value.

It was, therefore, necessary to augment these aforementioned inspection techniques with another which would give a truer indication of the mechanical properties existing in the casting. It is believed that the only method available is integrally cast test bars. Fig. 6 is an illustration of the correlation between properties of integral bars and those of castings. The bar graphs, indicating the results obtained from balanced chemistry bar stock and unbalanced chemistry shotted remelt stock, illustrate that a good correlation does exist.

Two Bars per Mold — It has, therefore, become the policy to require two integral bars be cast in each mold of critical investment castings. The first three lots of cast-

TEST BAR NUMBER	HEAT TREATMENT	YIELD STRENGTH (0.2% OFFSET), KSI	ULTIMATE STRENGTH, KSI	ELONGATION % IN/IN.	REDUCTION OF AREA, %
1	1900°F 1 HR	171.8	192.7	3.5	7.8
2	OIL QUENCH	171.8	192.7	5.5	8.6
3	AGE 925°F 1 HR	168.3	189.0	3.0	4.0
4	2100°F 2 HR	175.7	194.3	11.0	24.7
5	1900°F 1 HR OIL QUENCH	172.3	193.0	10.5	18.8
6	AGE 925°F 1 HR	173.8	194.3	10.0	25.4

Fig. 5—Effect of homogenization on test bars. Because of these data, a homogenization heat treatment has become mandatory for 17-4PH castings

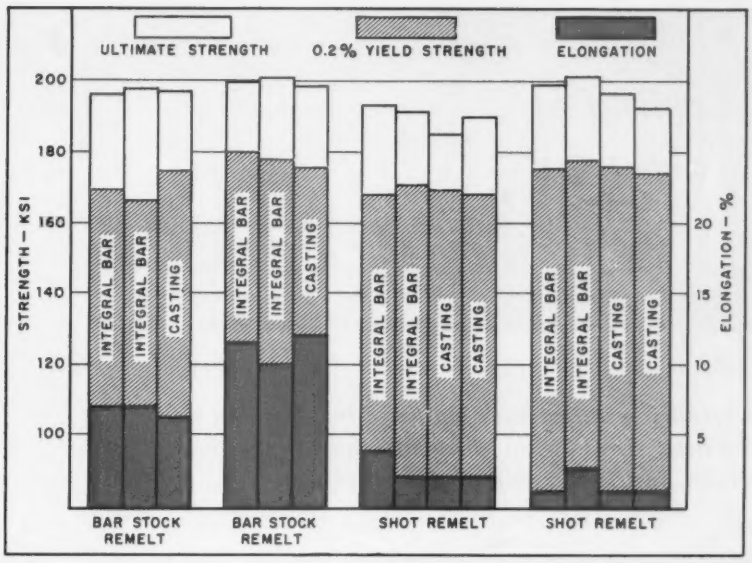

Fig. 6—Illustration of tensile strength and elongation for dissected castings. Bar graphs illustrate that a good correlation does exist between the properties of integral bars and those of castings

ings are subjected to destructive testing of one casting per lot to establish the correlation. After that, the results of tests on these bars along with the regular inspection tests provide the basis for acceptance of these castings. A random 2 per cent destructive inspection is conducted as a check. Fig. 7 illustrates one of the castings with the placement of the integral bars on the gating.

To summarize, the presence of microshrinkage and large amounts of dendritic-shaped ferrite are the major causes of low ductility and the resultant rejection of 17-4PH castings. It has been found that retarding the cooling rate of the mold minimizes microshrinkage, reduces the ferrite content, and reshapes the ferrite into a globular and blocky form. It has long been known that microshrinkage can be reduced or eliminated by the use of proper gating methods.

Extensive testing has indicated that closer chemistry control of 17-4PH has a profound effect on the ferrite content. Shotted material was found to have inadequate chemistry control for use in prime structural castings, but the use of remelted bar stock was found to have solved this problem. From the preceding comments, it is evident that 17-4PH is a very sensitive alloy requiring close chemistry control and precise foundry techniques. To produce prime structural castings of high standards and consistent quality, constant control of foundry practices and heat treatment must be maintained.

The question might be asked (and has been frequently) why not substitute another alloy which is not as critical as 17-4PH? Thus far, no alloy has been found that would be any less troublesome. The alloy has certain advantages over other alloys capable of achieving the strength required. However, it is not the intention of this paper to imply that 17-4PH is the ultimate. Other alloys are being considered and will be tested.

The No. 1 Problem—In the use of castings the problem does not necessarily lie in the alloy but rather in the knowledge of possible troublesome areas and their elimination through tighter specifications and further research and development in the casting field. Castings have not kept pace with the rest of industry, but they are an excellent means of reducing both volume and weight of structures economically.

As has been pointed out, castings offer many design advantages. Unfortunately, many designers have become very "gun shy" when it comes to the utilization of castings for other than "hardware."

Editor's Note: This paper was presented at the SAE National Aeronautic Meeting held in Los Angeles, Oct. 5-9, 1959.

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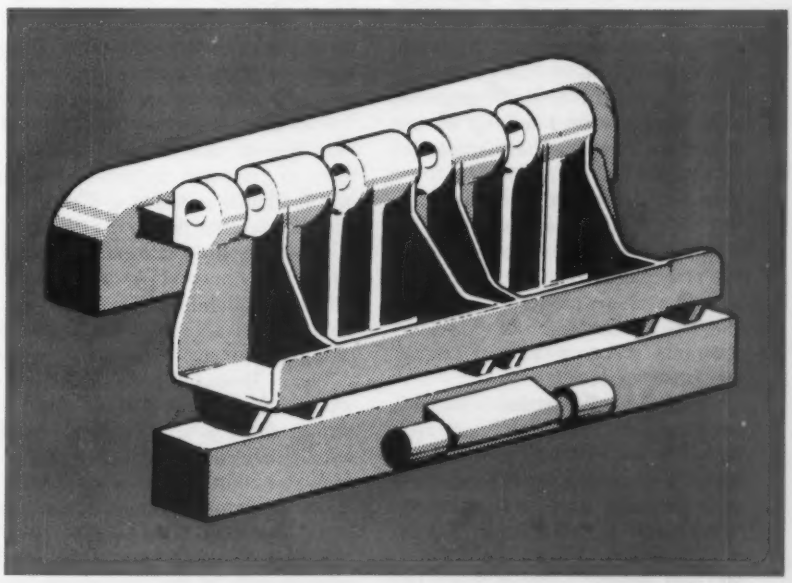

Fig. 7—Example of a casting with integral bars placed on the gating

Melting and Casting of

ALUMINUM BRONZES

Developments in foundry practices have improved the standing of the aluminum bronzes. This article discusses their properties, casting characteristics, melting, molding, and other factors

By J. G. DICK
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● THE ALUMINUM BRONZES made their first appearance about 1870. In those days the new alloy often was treated in the same manner as the tin bronzes and zinc brasses.

Because of this failure to recognize the peculiarities of aluminum bronze alloys, most early castings showed such faults as gas porosity, shrinkage cavities, dross inclusions, inconsistent mechanical properties, etc. These recurring faults fathered a reputation for untrustworthiness. In the last 30 or 40 years, however, developments in foundry practices permitting proper handling of the aluminum bronzes have radically improved their reputation.

Important properties of aluminum bronzes include the following: 1. Unusual combinations of mechanical properties, with distinct ability to retain these properties at fairly elevated temperatures. 2. Excellent resistance to corrosion. 3. Excellent resistance to wear.

Mechanical Properties — Individual mechanical properties vary considerably with alloy composition, method of casting, and heat treatment. Tensile strength may range from 50,000 to 120,000 psi, elongation from 0 to 30 per cent or better, and Brinell hardness from 110 to 400.

Interesting combinations of these properties may occur. For example, aluminum bronze alloys with tensile strengths of 100,000 psi or more may show ductility ranging from 0 to 15 per cent whereas alloys with tensile strengths in the 70,000-psi range may exhibit Brinell hardness of 140 to 350.

Ability of these alloys to retain their room temperature mechanical properties at moderately elevated temperatures is very good. It far exceeds the performance of other high-strength bronzes such as the manganese bronzes in this respect.

Corrosion Resistance—The entire alloy group shows excellent resistance to corrosion by most organic and inorganic substances. This ability extends even to the use of mildly alkaline solutions, usually a problem with copper alloy castings. As a result, aluminum bronzes are used extensively in chemical processing equipment.

Wear Resistance—Resistance to wear is very good, and aluminum bronze castings are used for gears, wear strips, cams, guides, etc. Apart from the ability to resist wear from direct mechanical action, these alloys have high resistance to cavitation erosion. Consequently, certain members of the alloy group are used widely in the production of impellers, pump castings, etc.

Alloys—The alloys used most extensively range from 5 to 15 per cent aluminum. Aluminum bronze casting alloys containing only copper and aluminum are rare, however. The presence of additional elements such as iron, manganese, nickel, and silicon, either individually or in various combinations, is common to nearly all alloys of commercial importance.

The composition of aluminum bronze, insofar as aluminum content is concerned (although other alloying elements have an influence here), has a definite effect on as-cast structure. In addition, the structure of the cast alloy is strongly affected by the treatment immediately after casting.

For example, the 7 per cent aluminum alloy cast and cooled in sand shows a pure alpha structure. On the other hand, the 10 per cent aluminum alloy cast and cooled in sand shows a considerable amount of the gamma$_2$ or eutectoid phase.

The presence of gamma$_2$ material, although desirable in certain instances, tends to reduce strength and ductility. Since the gamma$_2$ constituent develops from a breakdown of the beta phase into alpha plus gamma$_2$, starting at about 1050° F, castings in the 10 per cent

aluminum alloy can be secured with an alpha plus beta structure by removing them from the sand before this temperature is reached.

In fact, the safest procedure when producing aluminum bronze castings containing more than 9.5 per cent of aluminum, particularly where no subsequent heat treatment is projected, is to knock them out of the sand as soon as it can be assumed safely that the heaviest section has solidified properly. The castings then should be brushed free of sand and allowed to cool in air.

Under no circumstances should they be cooled with water, since this action again introduces structures which may be undesirable if further heat treatment is not planned. Where some heat treatment is to be applied eventually, less attention need be paid to the casting cooling rate since undesirable structures will be modified by heat treatment.

Another method of preventing the adverse effects of slow cooling is the addition of elements which tend to 1) retard beta phase grain growth at the high temperatures which exist immediately after solidification and 2) prevent formation of a coarse eutectoid structure during cooling in the mold. Iron is particularly efficient, although there is reason to suspect that small amounts of added manganese have a powerful influence. Nickel also has been used.

A particularly fortunate circumstance is that in addition to the value of these additions in offsetting the effects of slow cooling in aluminum bronze castings, they permit strength increases in proportion to their percentage addition. The efficiency of iron in particular is so great in inhibiting the development of undesirable structures as a result of the slow cooling that the aluminum bronze casting alloys used today seldom contain less than 1 per cent iron.

It should not be thought from the foregoing that the action of iron, manganese, or nickel is highly efficient where grain size control is concerned. This control can be achieved, however, by the addition of elements such as magnesium or calcium.

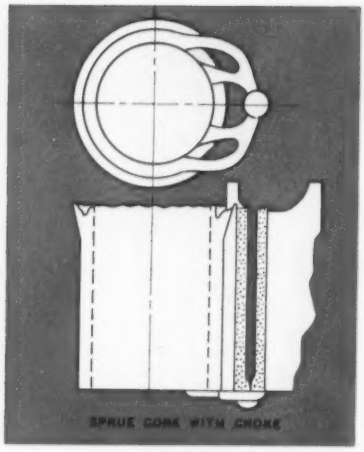
Heat Treatment — All aluminum bronzes respond to some heat treatment. Even the pure alpha alloys, with less than 8.5 per cent aluminum, show crystal growth and soften appreciably. As a general rule, however, only alloys which contain 9.5 per cent or more of aluminum are heat treated to any significant extent since, practically speaking, only beyond this 9.5 per cent value can heat treatment modify the mechanical properties radically.

Although many forms of heat treatment are used, one of the most common involves heating the alloy to a temperature within the beta zone and, after a brief but adequate soaking period, quenching to retain the beta structure.

Subsequent reheating at temperatures in excess of the eutectoid transformation temperature results in the development of mixtures of alpha and beta, the properties of each depending on the temperature and heating time used. Since beta is the strong, hard constituent and alpha the ductile constituent, many combinations of strength, hardness, and ductility can be secured by heat treatment variation.

It is most important to make a chemical analysis prior to heat treatment of aluminum bronzes since the proper heating procedure can be judged only on the basis of chemical composition. Naturally, only castings of similar analysis should be heat treated in any one batch.

The beta structure shows a pronounced tendency to excessive grain growth when heated within the



temperature ranges of the beta zone. For this reason, prolonged heating within this range must be avoided, and soaking periods must be kept to an absolute minimum. The addition of iron, manganese, and nickel helps to retard grain growth to some extent, but too much emphasis should not be laid on this factor.

A more important factor than the coarsening of the grain structure also is involved. Prolonged heating with attendant grain growth results in a weakening of the beta phase grain boundaries. Where such a condition has existed during heat treatment, it is common for castings to break completely when dropped. Evidence uncovered recently appears to indicate that segregation of aluminum oxide to the grain boundaries during grain growth is at least partially responsible.

When heavy cross sections are involved, prolonged soaking times may be required. In such instances, modified procedures may be used, involving heating to near the beta zone, slowly cooling to a desired alpha plus beta zone, and subsequently quenching in this zone.

Aluminum bronze alloys containing more than about 12.5 per cent aluminum show the appearance of beta plus gamma$_2$, which contributes high hardness and ability to resist abrasive wear. Even in these alloys, early shakeout of castings is required to avoid development of the alpha plus gamma$_2$ structure.

Melting Units—Difficulties associated with melting of aluminum bronzes depend largely on type of equipment used. Where electric arc or low or high frequency induction furnaces are involved, few melting troubles normally are experienced with good practice. Melting units of these types still are uncommon in the ordinary brass or bronze foundry, however; by far the majority of such foundries use gas or oil-fired crucible or reverberatory furnaces.

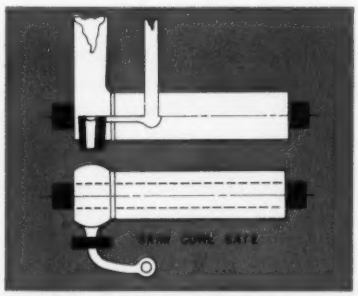
Furnace Atmosphere—One difficulty concerns what type of furnace atmosphere should be maintained during the melting cycle. The aluminum bronzes exhibit two characteristics which, at least insofar as melting atmosphere conditions are concerned, appear to work in direct opposition to each other: 1. The ability to absorb hydrogen originating directly or indirectly from some form of poor melting practice. 2. The tendency to composition variation during melting which occurs as the result of oxidation losses of aluminum.

To assist in avoiding hydrogen gassing, oil or gas-fired furnaces should be operated with an oxidizing atmosphere. Although a slight excess of oxygen should be present at all times in the furnace combustion products, too much oxygen means heavy melting losses by aluminum oxidation, with resultant uncertainty about final chemical composition and mechanical properties. The precise extent to which the proper type of furnace atmosphere is important varies with the type of oil or gas-fired equipment. It is more important, for example, to maintain a consistently correct atmosphere in an open-flame reverberatory furnace than in a crucible furnace.

The surface area exposed to the furnace combustion products per unit volume of melt is much higher with a standard reverberatory furnace than with a crucible unit. Since both hydrogen absorption and oxidation losses are functions of this ratio between surface area and volume of molten metal, the dependency of good melt quality on melting atmosphere and type of melting unit is obvious. Generally, therefore, it is preferable to melt the aluminum bronzes in a crucible furnace instead of a reverberatory furnace.

This generalization does not mean that reverberatory furnaces cannot be used at all. They are used in many foundries for the production of melts to pour heavy castings. Usually, however, rigid control of furnace atmosphere is applied, frequently involving use of devices which are not standard equipment in foundries which handle smaller melts.

There are two schools of thought where furnace atmospheres for aluminum bronze melting are concerned. These revolve around the two previously mentioned characteristics of these alloys. One requires that the alloy be melted under slightly reducing furnace atmosphere conditions—that is, with a slight excess of fuel over air. This approach prevents heavy oxidation losses and resultant composition changes. Before the melt is removed, it is swept with nitrogen gas, exposed briefly to a comparatively heavy oxidizing furnace atmosphere, or treated in some other way to in-



sure freedom from gas absorption.

The second school demands that the furnace exit flame be a rich green color tinged with yellow. This color is indicative of an oxidizing furnace atmosphere (an excess of air over fuel), and the oxidation losses of aluminum are taken into consideration by compensating higher starting aluminum concentrations and by a judicious mixing of old and new material in the melt. Use of an oxidizing atmosphere minimizes the possibility of gas absorption.

Both methods have certain virtues. Melting initially under reducing conditions and using some treatment of the melt to guarantee freedom from gas are of value when reverberatory furnaces are used. Use

of an oxidizing atmosphere throughout the entire melting cycle is recommended for crucible melting. The surface area exposed per unit volume is comparatively low, and oxidation losses are correspondingly slight. Gas absorption is, as stated before, minimized to the point of insignificance.

Furnace Charge — Regardless of the method of melting, the initial charge never should include material with a large surface-area-to-volume ratio. Such materials include turnings, drillings, shavings, and small castings. The first charge always should consist of ingots or other large solids. When it is necessary to use materials such as turnings, they should be charged to a bath of molten metal after initial melting down of solids.

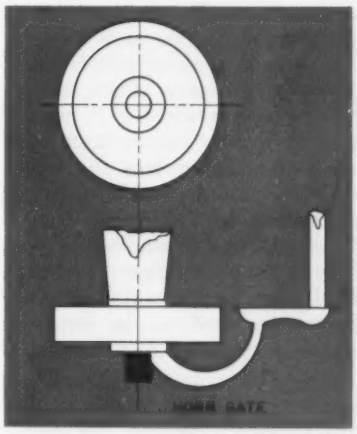
To maintain reasonable control of final composition during absorption of foundry returns, the amount of old material charged to any given melt must be adjusted so that no more than 50 per cent of the total charge consists of old material. Preheating of the charge can assist in securing good quality melts by reducing the time required to produce a melt.

Melt Temperature — Again, regardless of the method of melting, temperature of the melt never should exceed markedly the desired maximum pouring temperature for the castings involved. Although pouring temperature may vary with the casting cross sections, the melt should not exceed the selected pouring temperature by more than 100° F—and 50° F is preferable.

Under no circumstances should any aluminum bronze melt be held in the furnace once the desired temperature has been reached. Close co-operation between molding floor and melting room is required. Melts should not be started without assurance that sufficient completed molds will be ready when the withdrawal temperature is reached. There are, of course, specific reasons for avoiding both overheating and overlong retention at temperature. Oxidation losses and the possibility of gas absorption increase with retention of the melt in the furnace and with higher temperature.

Fluxes—Many fluxing substances have been suggested for use in aluminum bronze melting. Impermeable covers, such as glass, prevent hydrogen gas absorption but also prevent the removal by oxidation of any hydrogen absorbed in the initial melting-down stages. If a flux is required, ordinary salt may be used sparingly before the melt is removed from the furnace. Some foundrymen prefer to mix a small amount of sodium aluminum fluoride or cryolite with the salt, although there is a danger of creating a liquid slag rather than a dry, easily skimmed dross.

Some writers recommend manganese copper as a deoxidant for aluminum bronze melts, but the writer feels that this step is not necessary.



Molding—Molding techniques for the aluminum bronzes consider the high shrinkage characteristics of the group as well as the tendency to drossing, which manifests itself particularly wherever undue turbulence during pouring occurs. Attention to chilling and risering helps to avoid shrinkage cavities, and gating techniques chosen with an eye to getting the metal into the mold without excessive turbulence are essential to avoid heavy dross formation.

Molding sands used in the production of aluminum bronze castings must be controlled carefully. When green sand molding techniques are employed, the sand must have comparatively high permeability and as low a moisture content as possible. Fine-grained sands or unduly high moisture can cause blowholes, pinholes, and general porosity. Hard spots or wet spots in the mold can cause blows and should be avoided by even ramming and proper mulling of the sand. The writer has had good success with CO_2-hardened molds and cores. The low moisture content and high permeability of such sands are excellently suited for work in this field.

Chills—Use of cast iron or graphite chills to induce directional solidification is recommended. They commonly are placed at the base of a heavy cross section, with or without a riser at its upper end. The principle is to induce solidification in such a direction that hot metal is made available to compensate for volume shrinkage in the heavy section during cooling.

Where light and heavy sections join, chills are used to chill the light section directionally to the heavy section, insuring that the heavy section is fed adequately by a riser or some similar means. Conversely, where a heavy section cannot be risered properly, chills may be used to solidify the heavy section directionally toward the light one, making sure that the light section has a means of receiving hot metal to take up the shrinkage of both the heavy and light sections. From even these brief references, it is obvious that the question of where to apply chills, as well as their size, number, and shape, are matters in which only experience can be the final criterion.

A suggestion that chills should be used in the production of a casting will not be well received by many foundrymen, who feel that chilling in many instances merely serves to shift shrinkage areas around in the casting and does little to solve the problem. It is true that haphazard chilling frequently can create a more difficult situation than that which existed when no chills were

TABLE I—Typical Mechanical Properties of Aluminum Bronze Casting Alloys

Al	Fe	Mn	Ni	Cu	Yield Point, psi	Tensile Strength, psi	Elongation, %	Brinell
10	..	..	..	90	25,000	65,000	15	121
10	1	..	..	89	30,000	70,000	15	143
9	2	..	..	89	28,000	70,000	30	131
9	3	..	..	88	30,000	75,000	30	146
10	4	..	..	86	35,000	75,000	18	163
9	..	..	5	86	30,000	75,000	35	143
10	5	3	5	77	45,000	90,000	6	187
12	4	..	..	84	40,000	80,000	3	202

applied. This danger is not necessarily a fault of the principle, however; it simply indicates that chilling has been used without due regard for all of the factors involved.

Risering — Risering must allow adequate—in fact, generous—provision for the feeding of heavy cross sections. Massive risers and feeding heads are required, and risers for aluminum bronze castings approximating 50 per cent of the total cast weight are common. Much of the difficulty in the production of castings in these alloys stems from an insufficient supply of feed metal. The average ratio of riser weight to casting weight for 20 aluminum bronze castings poured recently in the foundry managed by the writer was 0.91 to 1, an average of 47 per cent of the total weight cast.

In recent years, much work has been done to reduce the size of risers required to feed aluminum bronze castings. This work has centered around the use of exothermic compounds or insulating materials for riser sleeves or pads. The aims are to generate heat in the neighborhood of the riser or to decrease the rate at which heat is lost by the riser. In either event, the riser metal stays molten longer, permitting a reduction in riser dimension, particularly its cross-sectional area.

A secondary use, particularly of the exothermic material, is to secure a necking-in of the riser to a small cross section at the point of its junction with the casting to reduce cutoff costs and cleaning times. Both endeavors have had considerable success, but it should be emphasized that use of riser sleeves, pads, and neck-ins of these types requires considerable experience.

Gating—To avoid undue turbulence and subsequent dross formation during pouring, the general technique with aluminum bronze castings is to gate, wherever possible, into the lowest level of the casting. Normally, the hottest metal poured is at the bottom of the casting, with the coldest metal in the riser. To minimize effects of this unfortunate situation, it is general practice to pour hot metal into the riser, once it has been filled partially by bottom pouring, to secure better feeding. Chills at the bottom of the casting, where possible, also help to promote proper directional solidification and to correct the situation introduced as the result of bottom pouring.

Ratios of sprue, runner, and ingate areas of the order of one, two, and four are imperative, and strainer gates, reverse horn gates, skim gates, step gates, etc., are used extensively. Use of pouring basins with plugs to permit controlled flow into the sprue without turbulence and dross formation is common.

For example, heavy circular castings of uneven cross section, such as gear blanks, commonly are cast with a skim gate and an attached reverse horn gate. The large end of the horn gate leads into the center or hub of the casting, directly under the riser.

Thin sections of comparatively large surface area, such as plate or strip castings, should be cast with a long gate with a dross trap, the casting being ingated at a multiplicity of points.

Stick or bushing castings commonly are cast horizontally, the casting being continuous, with a large riser at one end. The gating involves a skim gate with an attached reverse horn gate leading into the riser well.

Large bushings or deep rings are cast vertically, two reverse horn gates leading into the bottom of the casting at diametrically opposite points. Two of the several risers required, if individual risers are used, are located above the ingates. The small ends of the horn gates are attached through strainer cores at the opposite ends of a runner bar. A central sprue is attached to the runner bar. When the mold is very deep, the sprue is stepped down successively so that no single drop involves a height of more than 10 in.

All mold areas where metal must flow into a blind end should be well vented, and, when the pouring of a casting is complete, all risers should be covered with exothermic or insulating powder. Under no circumstances s h o u l d aluminum bronzes be cast with interrupted pouring. The facility with which an oxide film is formed by air contact indicates that with a pouring temperature anywhere near the solidification temperature, there always is the possibility of casting sections being separated by oxide films formed as a result of interrupted pouring.

TABLE 2—Changes in Mechanical Properties with Heat Treatment

Al	Fe	Mn	Ni	Cu	Heat Treatment	Yield Point, psi	Tensile Strength, psi	Elongation, %	Brinell
10	1	..	..	89	as cast	30,000	70,000	15	143
10	1	..	..	89	No. 1	40,000	90,000	12	187
10	1	..	..	89	No. 2	50,000	90,000	6	223
10	4	..	..	86	as cast	35,000	75,000	18	163
10	4	..	..	86	No. 1	40,000	95,000	12	202
10	4	..	..	86	No. 2	55,000	100,000	9	228
10	5	3	5	77	as cast	40,000	90,000	6	179
10	5	3	5	77	No. 1	65,000	110,000	4	228

Editor's Note: This paper was presented at the Missouri Valley Regional Conference held at Rolla, Mo., Sept. 24-25, 1959.

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METALLURGY OF IRON CASTINGS

Factors not generally obvious in cast iron metallurgy but which are important in the manufacture of engineering cast irons are discussed

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Fig. 2—Structure of iron obtained when graphite precipitates early, A; late, B; at just the right time, C

● KNOWLEDGE of the basic fundamentals of cast iron metallurgy has been spread very rapidly during the last decade by technical societies and publications. Increasing use of this knowledge in industry has led to the development of many techniques and procedures for producing engineering-type cast irons.

Chemically, cast iron is an alloy of iron, carbon, and silicon, usually with several other elements. The co-relationship of iron, carbon, and silicon is well known, but the effect of minor elements such as manganese, sulfur, phosphorus, titanium, oxygen, etc., largely determines the metallurgical behavior of cast iron. The physical characteristics of cast iron and the metallurgical structure often bear no relationship to the chemical composition.

Iron-Carbon Diagram—All discussions of cast iron must, of necessity, begin with the iron-carbon diagram or, more properly, the double iron-carbon diagram (Fig. 1), which shows the constitution of iron-carbon alloys. For the sake of simplicity consider silicon as carbon, in that its behavior can be expressed as a carbon equivalent which equals carbon plus one-third silicon.

In this diagram, the broken lines represent the metastable iron-carbide system, whereas the solid lines represent the stable iron-graphite system. Alloys falling to the right of the eutectic point are hypereutectic alloys and, as the liquid melt is cooled, deposit excess carbon directly from the melt as graphite in the stable system or as carbide in the metastable system. The remaining liquid concentrates along the liquidus until it has a eutectic composition and then solidifies as the austenite-graphite or austenite-carbide eutectic.

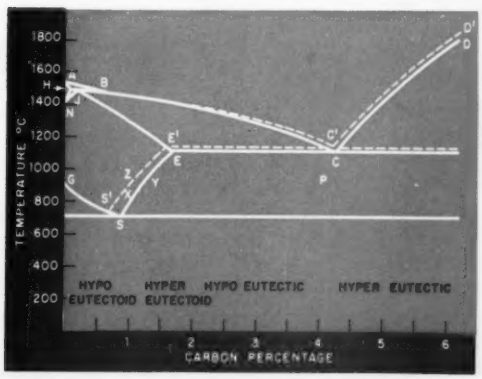


Fig. 1—In this double iron-carbon diagram the broken lines represent the metastable iron-carbide system; solid lines show stable iron-graphite system

All this seems fairly straightforward, and indeed it would be, except that it is difficult to forecast whether the stable system of iron graphite or the metastable system of iron carbide will apply. The more the cooling rate departs from equilibrium, the greater the tendency for iron-carbide to make an appearance. As the composition becomes increasingly hypereutectic, it requires a faster rate of cooling to produce carbides.

On the left side of the eutectic

composition, we are dealing with hypoeutectic alloys. These solidify as crystals of primary austenite; the liquid concentrates to the eutectic composition and solidifies as the austenite-carbon eutectic.

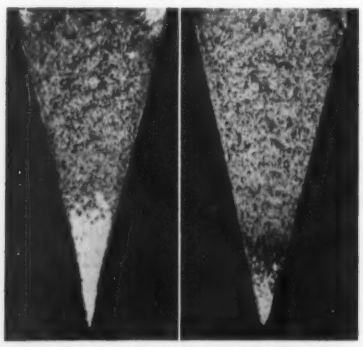
Since the equilibrium diagram provides us with no means of forecasting whether excess carbon is going to occur as iron-carbide or graphite, it is of little practical use in the production of cast iron. Therefore it is necessary to adopt some other means of predicting the pattern of solidification and the constitutional changes that occur when a liquid cast iron becomes a solid cast iron casting.

The whole question of the structure and properties of cast iron is tied up with its manner of solidification and its relative tendency to solidify with free carbides in the metastable system or with graphite in the stable system. Without going deeply into the actual mechanism, a clear mental picture can be developed by considering several possibilities that could occur in graphite expulsion from the melt.

If graphite is precipitated early in solidification, directly from the melt, it has ample opportunity to grow and act as a center of crystallization for further graphite precipitation. The net result is a final structure (Fig. 2A) showing coarse graphite flakes.

If graphite is precipitated very late in solidification, its growth and distribution must, of course, be affected by the presence of growing austenite crystals in the melt. Not having the opportunity to grow, the graphite is small in size and is located in the last metal to freeze—i.e., it takes on a directional pattern at the crystal boundaries (Fig. 2B).

Fig. 3—Chill depth, left, resulting from undercooling is reduced by nucleation, right



Both of these extremes lead to weakness in the cast iron—the first by virtue of large, interlocking graphite flakes and the second by virtue of orientation of the graphite, in that it is concentrated at the crystal boundaries. If graphite is suppressed entirely, a white iron results.

The whole trick of the metallurgical control of cast iron lies in forcing the graphite to deposit at just the right time during the process of solidification. This action will give the structure shown in Fig. 2C.

This timing may be accomplished by several means. The first, obvious method is to vary the rate of cooling in relation to composition of the melt. If a soft iron (high CE) which normally would give coarse graphite is cooled rapidly so as not to allow time for graphite growth, the result would be smaller graphite flakes less subject to the directional influence of growing austenite crystals. Use of chills or denseners in molds has become common practice in many foundries in an attempt to make a soft, weak, porous cast iron give a stronger, harder, denser casting. Obviously, this method has distinct limitations.

The second method is nucleation, inoculation, or graphitization. In this instance, coarse graphite is avoided by having a more hypoeutectic composition and by forcing early graphite precipitation with suitable ladle additions, usually involving silicon in one or more of its many forms. This forced precipitation of graphite modifies the influence of growing austenite crystals on the graphite shape and, therefore, provides small graphite flakes of random orientation. In this method, an iron which would tend to solidify white is forced to solidify gray.

A third method is the addition of small quantities of carbide stabilizers to the melt. They tend to cause solidification in the metastable carbide system, thereby preventing precipitation of graphite which is "too early" and would cause large graphite flakes in the final structure. Naturally, these additions would be more effective in high-carbon or more hypereutectic compositions, whereas graphitizing additions would be more effective on more hypoeutectic compositions.

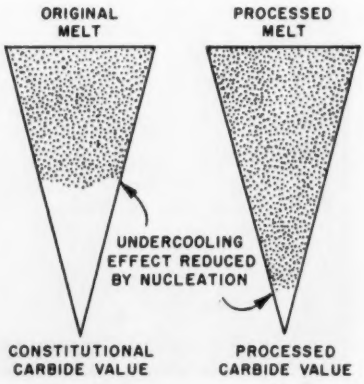
How To Proceed—The metallurgy of cast iron involves selecting a composition, usually expressed as a carbon equivalent, which is suited to the average cooling rate of the casting to be made, then adding a graphitizer to force graphitization where cooling is faster than average, or adding a carbide former to retard graphitization where cooling is slower than average. The art of the process lies in knowing just how much of each type of control to use and just how far each type of control will be effective.

The usual procedure is to employ some form of chill or wedge test to determine how the iron is going to solidify with regard to graphite precipitation. The chill test gives the foundryman his guide and index, which, by experience, he can relate to the castings he is going to make. With light-section castings he uses a low chill value. This means he is using an iron which tends to solidify soft. With heavier-section castings he uses a higher chill value, representing an iron which tends to solidify hard—that is, one in which graphite deposition is suppressed.

The metallurgy of cast iron is, perhaps, better approached by considering the production of a well known proprietary material known as Meehanite metal. The Meehanite process and Meehanite metal have been known to the foundry and engineering industry for more than 30 years, and this fact alone warrants a close look into some of the details of the process.

It commonly is felt that the Mee-

Fig. 4—Undercooling effect on carbide value shown in Fig. 3



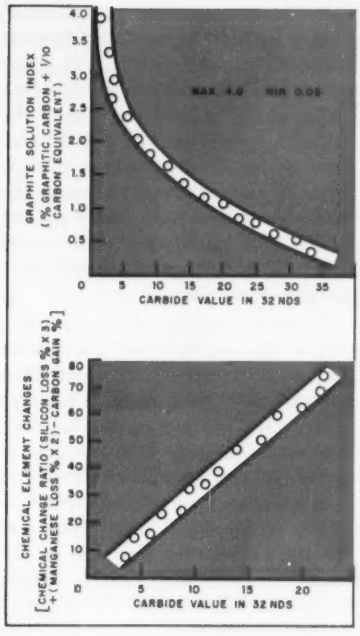

GRAPHITE SOLUTION INDEX
(% GRAPHITIC CARBON + 1/10 CARBON EQUIVALENT)
MAX. 4.0 MIN. 0.05
CARBIDE VALUE IN 32 NDS
CHEMICAL ELEMENT CHANGES
[CHEMICAL CHANGE RATIO (SILICON LOSS % X 3) + (MANGANESE LOSS % X 2) – CARBON GAIN %]
CARBIDE VALUE IN 32 NDS

Fig. 5—Importance of graphite control, top, and chemical control, bottom, to carbide value

hanite process consists of the use of alkaline earth silicides such as calcium silicide for the forced graphitization of the melt by nucleation or inoculation. Basically this is true; we use alkaline earth graphitizers because they have proved their reliability. But there is a lot more to the manufacture of Meehanite or, for that matter, any engineering cast iron than the addition of some special graphitizer to a ladle of molten metal.

Early in the development of the Meehanite process, the need for a measure of the melt that would give some indication of the structure that would result from a given rate of cooling was recognized. The conception of base metal constitution measured by a chill test, which gives the constitutional carbide value, was developed. This value is related to the section of the casting and the physical properties desired.

The constitutional carbide value actually is a measure of the degree of undercooling of the melt with respect to graphite precipitation. Undercooling is a well known metallurgical phenomenon. When a melt of any metal is cooled, it reaches the liquidus which corresponds to its composition. At this point solidification should occur, but the melt actually may cool to a temperature below this point without such solidification occurring. This is undercooling or supercooling. When solidification does occur, it is spontaneous and rapid and results in a small crystal size.

When a cast iron melt cools below the point of graphite precipitation without graphite's being expelled from solution, then undercooling with respect to graphite has occurred. It is not understood exactly what determines and controls this undercooling, but it generally is conceded that the degree of undercooling experienced is related to the presence or absence of available nuclei in the melt which would favor graphite precipitation. Where nuclei are absent, the tendency is for undercooling to occur.

We regard the constitution of the metal as a measure of the degree of undercooling that exists. Whatever the mechanism, the result of undercooling is to favor the solidification of the melt with free carbides, instead of graphite. That is, it tends to solidify in the metastable system. This tendency is measured readily by a simple wedge test, and one of the essential features of the Meehanite process is the control of the constitutional carbide value of the melt. This means that a defined and controlled degree of undercooling is aimed at.

It is well to distinguish between the carbide value due to composition and that due to undercooling. Consider Fig. 4.

If it is presumed that no undercooling exists, then every melt of each composition would have a definite carbide value. If the factor of undercooling is introduced, then each melt has a higher carbide value than normally would be expected from that composition. This increased carbide value is the degree of undercooling, which is so important in the control of graphitization. The left hand wedge of Fig. 4 represents the carbide value with undercooling, whereas at the right undercooling has been removed, leaving chemical chill.

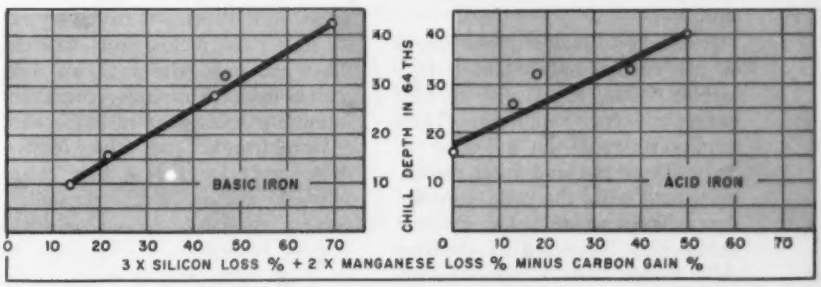
Over the years it has been possible to work out the exact chill that is normal for any given composition. In this, there is no substitute for experience. The factors responsible for undercooling in the melt also have been isolated.

Since undercooling, or constitution, depends on nuclei in the melt, it follows that the first point of control is the available nuclei in the charge. Unquestionably, the most important nuclei is graphite itself.

Control Starts with Charge—Graphite is a very refractory substance, and its solution in molten metal during the melting process requires time. If the charge contains large quantities of graphite and the graphite itself is large, it is possible for some graphite to remain as small, undissolved particles in the final melt. If it does, these undissolved particles act as nuclei for graphite precipitation, thereby preventing undercooling in the melt. Thus the first point of control in obtaining a base metal which does exhibit the desired degree of undercooling is to be sure that the charge into the furnace contains the correct quantity of graphite in the correct size.

The procedure for producing cast iron of controlled constitutional and carbide values is outlined in a series of U. S. patents owned by Meehanite Metal Corp. The latest of these, from which Fig. 5 is taken, is U. S. 2,793,114. The upper graph relates to graphite control and the lower one to chemical control, which will be discussed later.

Fig. 6—Chill depth is related to melting loss on 1-in. section for basic iron in the left graph and for acid iron in the right graph



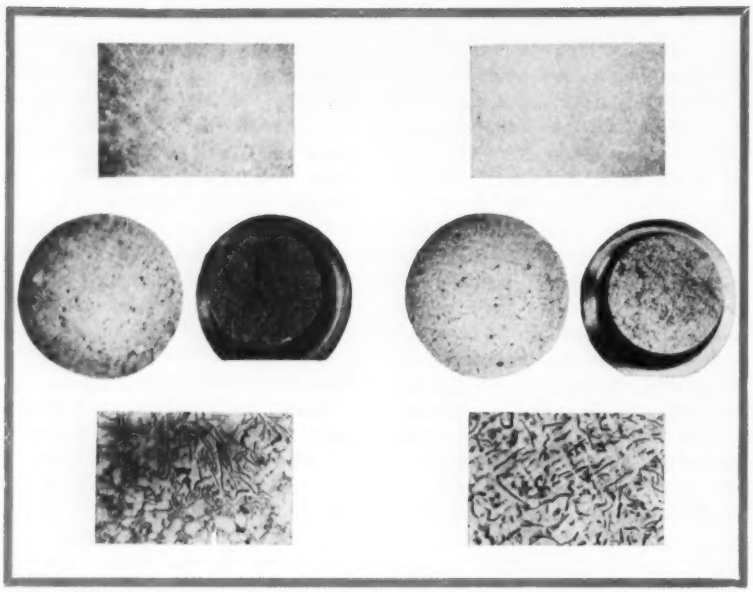


Fig. 7—Structure of iron as melted, left, has mixture of coarse and fine graphite. Nucleated iron, right, is fine grained and has greater strength

The phenomenon of the characteristics of the metal being determined by the characteristics of the charge often has been referred to as heredity. It is well known, for example, that one type of pig iron gives a different result from another type, and it is quite probable that any observed differences of this kind find their origin, first, in the size, amount, and distribution of the graphite flakes in that pig iron.

Other important nuclei are sulfides and silicates. Sulfide, or, more properly, manganese sulfide, which exists in the solid condition while the metal is still molten, definitely favors the precipitation of flake-type graphite. For this reason, in the production of nodular graphite, for example, manganese sulfide has to be eliminated from the melt by elimination of the sulfur. The same effect could be achieved by leaving sulfur high and eliminating manganese. Nodular graphite formation represents a high degree of undercooling with a low chemical chill.

It is easy to melt a given charge in the cupola and obtain a high carbide value, simply by melting under oxidizing conditions. These conditions would be indicated by high silicon loss and high manganese loss during the melting operation. The carbide value obtained in this way, however, is a chemical chill, rather than a true constitutional chill. It does not represent undercooling, and it cannot be destroyed by simple nucleation.

The importance of control of chemistry during melting and of its relation to the carbide value of the melt can be illustrated simply. It has been shown in Fig. 5 and in a different way in Fig. 6.

In a series of melts over a period of time, it was found that with a constant charge, the carbide value bore a direct relationship to silicon loss, manganese loss, and carbon pickup in melting. If these three factors are combined in a purely arbitrary formula, which is regarded as the oxidation coefficient—i.e., 3 times silicon loss plus 2 times manganese loss minus carbon pickup—there is a straight-line relationship between this coefficient and the carbide value. Knowing this ratio for normal melting conditions helps materially in separating the true constitutional chill from the chemical chill.

The left graph in Fig. 6 illustrates chill depth vs. oxidation ratio in a basic melted iron, whereas the right one relates to an acid melted iron. The same general relationship holds good in both cases.

Graphitization of the Melt—After preparation of a base metal with the desired degree of undercooling, the next step is graphitization or nucleation of the melt, so as to prevent occurrence of stable carbides in the structure. Nucleation is a study in itself, and the addition of a small quantity of a nucleant such as calcium silicide produces an immediate lowering of the carbide value, out of all proportion to the amount added. This is because undercooling present in the melt is removed completely by the addition of nuclei, probably in the form of carbide particles generated by calcium.

By setting up a definite constitution in the metal—that is, a definite degree of undercooling—and then destroying it in a definite amount relating to the section of the casting to be poured, it is possible to get a uniform structure in the final casting, which may have many different sections and which may exhibit a variable cooling rate in the mold. The combination of initial nuclei control and deliberate nuclei addition, along with chemistry control, is necessary to achieve this end. Either one by itself will accomplish nothing.

Here again, experience is the best teacher, and over a period of time it has been possible in the Meehanite process to work out the carbide values which are best suited for heavy casting sections. It also has been possible to work out the ratio of wedge reduction or carbide reduction for each range of physical properties required. For example, when a 50,000-psi iron is produced, the constitutional wedge value should be at least 16/32, and this should be reduced at least one-third by a suitable inoculation. Failure to adhere to both of these conditions will not achieve the desired physical properties and will cause a variation in properties from one casting section to another poured in the same metal.

Eutectic Cell Count—The process of nucleation is well illustrated by the eutectic cell count. It is well known that hypereutectic graphite is generated from within the growing austenite cells, and the number and extent of these austenite cells determines, to a large extent, the nature of the graphite flake that results. Where a large number of cells occurs, the metal is inherently fine grained and the properties are usually better. With suitable metallographic techniques, it is possible to develop the cell

structure in a cast iron, and this method gives a very good picture of the nucleation process.

Consider, for example, the structure and cell size of an iron as melted and the same iron after it has been nucleated. This condition is illustrated at the left in Fig. 7. The structure of the as-melted iron shows coarse graphite, along with some finer and interdendritic graphite. This structure means that there has been some normal solidification and some undercooling. The coarse graphite represents the composition, and the fine graphite represents undercooling.

The addition of a nucleant does two things. It removes all signs of undercooling, and it promotes crystallization at many points. The net result is a fine-grained structure with a greater strength (Fig. 7, right). Nucleation raised the strength from 40,100 psi to 54,700 psi and reduced the chill from 24/32 to 6/32 by removing undercooling.

There are two extremes to this normal example. One is where the original melt is strongly undercooled and exhibits a large quantity of carbides. In such a case, nucleation may be sufficient only to prevent some of the undercooling and provide a structure free from carbides and with some undercooled graphite. Where this situation occurs, the composition of the melt should be adjusted to remove stable carbides.

The other extreme is where the original melt is devoid of any tendency to undercool. In such an instance, nucleation may give a slightly refined structure, but usually there is no notable change in strength. In fact, on such a base metal nucleation is wasted. The dependable manufacture of cast iron to engineering specifications involves control of the iron before and during nucleation.

Another factor that should be borne in mind when a melt is nucleated is that the removal of undercooling by nucleation is not always a permanent effect; the tendency for undercooling may return as the treated metal is allowed to stand. This tendency for nucleation effect to fade depends largely on the type of nucleant used and on the condition of the base metal.

If the melt is oxidized and dirty, containing inclusions which will react with the nucleant, efficiency of the nucleant obviously will be reduced. Such reactions take time, and the net result is an immediate lowering of the chill when the addition is first made, followed by a gradual increase in chill value as the nucleant is neutralized. For this reason, castings poured from a ladle of metal may vary considerably according to the time of pouring. This factor must be considered by any foundry making quality castings. The usual procedure is to melt under nonoxidizing conditions and to add enough nucleant to allow for some time decay.

Silicon and Manganese—Essentially, silicon is a graphitizer. When it has performed this function, its presence in increasing amounts leads to an increase in hardness of the matrix and a decrease in toughness. As a ferrite former, increasing amounts of silicon eventually result in a completely ferritic matrix not noted for its mechanical properties, but useful for heat and scale resistance and, in larger amounts, for corrosion resistance.

Manganese undoubtedly is the most important minor element, and a whole book could be written on its effect on the metallurgy of cast iron. First, it lowers the pearlite transformation temperature, thereby tending to produce an austenitic or martensitic matrix, rather than a pearlitic one. Manganese is a powerful deoxidant and has a strong affinity for sulfur. As a result, some manganese always is tied up with oxygen and some with sulfur. The presence of manganese oxides-silicates-sulfide complexes in the melt has an extremely important bearing on the nature of the cast iron.

Fig. 9—A higher magnification of Fig. 8 shows that dendritic pattern is due to segregation of sulfides and oxides

Any melt high in manganese oxides or silicates has been melted under oxidizing conditions. This type of melt is not fully responsive to nucleation, presumably because it already has nuclei in the form of silicates, and the effects of nucleation wear off rapidly. This type of melt also is prone to internal casting defects, and castings made from oxidized metal usually are less dense than those made from more normal metal. As a rule, sulfides also occur with manganese silicates, and this characteristic permits a pattern of segregation of sulfides to be observed with a sulfur print.

A metal which has been subjected to oxidation shows a definite dendritic pattern on a sulfur print, as in Fig. 8. On higher magnifications (Fig. 9) it can be seen that this pattern is due to the segregation of sulfides and oxides—usually of manganese in the interstices between the growing dendritic crystals.

Where solidification conditions are favorable, these oxides and sulfides (better termed "dross elements") tend to coagulate and float towards the cope of the castings. This movement is one reason that there always is a tendency for slag defects on the surface of castings made from oxidized metal.

The amount of manganese, or, for that matter, of sulfur, in the metal has little to do with the appearance of this type of structure. It can occur with a low-manganese

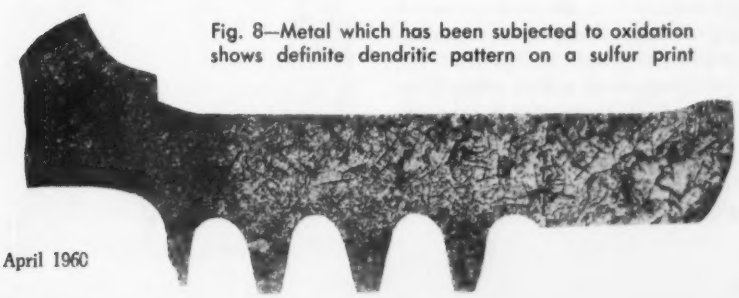


Fig. 8—Metal which has been subjected to oxidation shows definite dendritic pattern on a sulfur print

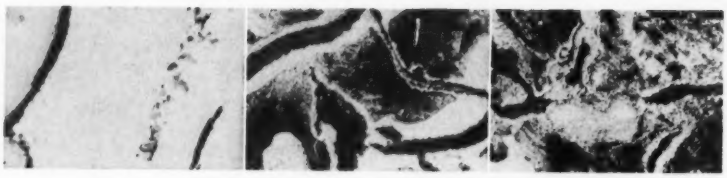


Fig. 10—Crankshaft metal shows nonmetallic inclusions and extensive decarburization from chemical action between oxide slags and carbon

iron and with a low-sulfur iron. The important thing is the amount of manganese lost during melting. If, for example, manganese loss is in excess of 20 per cent, it is almost certain that the resultant metal can be classed as oxidized. The high manganese loss means the production of high quantities of manganese oxides, and in acid irons this production invariably means that these oxides will be in the metal.

In basic irons there is a tendency to reduce some of the manganese back into the metal and also for the basic slag or fluxing action to remove a considerable quantity of these oxides. To determine the effect of manganese on a metal, from the standpoint of metallurgical structure, it often is far more important to consider the manganese not in solid solution—that is, the manganese which exists in the form of sulfides and oxides—and it is particularly important to consider the amount lost during melting.

Wherever this dross tends to accumulate, there is a definite tendency for a poor, inferior type of structure. The graphite is large and blown in nature, and areas of free ferrite occur in what normally would be a fully pearlitic matrix. The occurrence of this type of structure cannot be predicted on the basis of the chemical analysis alone. This point is illustrated in Fig. 10, which represents a crankshaft made from oxidized metal.

As already indicated, an oxidized metal may upset completely the control of the constitutional to process ratio, which is important in determining the uniformity within a given casting made in an engineering cast iron.

It is possible to illustrate the part the constitution plays in uniformity by a chill step bar test poured in two different irons and illustrated in Fig. 11. In both, chemistry and final wedge value were identical. In the upper specimen, the original wedge value of the melt before nucleation was about ten, whereas in the lower it was about six, which was practically the same as the final wedge value after nucleation. Where nucleation was positive, as at top, a uniform depth of chill and a uniform structure resulted, regardless of the casting section.

In another instance, where this principle was utilized to the full, a section taken from a 36-in.-diam roll casting showed a completely uniform Brinell hardness across the whole section. This casting was poured in type GM Meehanite metal, and a section is shown in Fig. 12.

Because manganese has a potent effect on the transformation temperature and the formation of pearlite, it is an almost essential ingredient in any cast iron which is to be heat treated. It is extremely difficult to harden adequately an iron which is low in manganese. All of the so-called high-duty cast irons should have a manganese content of at least 0.8 per cent. For all practical purposes, any manganese content above 1 per cent invites difficulties due to gasification or oxidation, unless the metal is melted in a basic furnace.

The exception, from the standpoint of hardenability, is nodular cast iron. In it, a lower manganese content is permissible and does not affect hardenability. This exception is logical, of course, since there is very little sulfur, which would neutralize some of the manganese normally in solid solution in an ordinary cast iron.

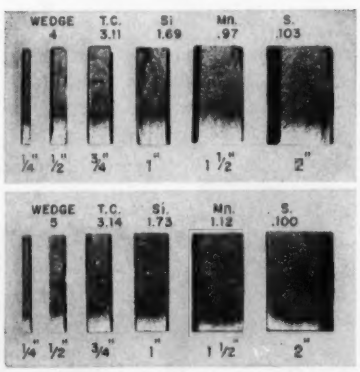
Effect of Sulfur—Sulfur is perhaps the next most important relatively minor element found in cast iron. By itself, sulfur definitely is a hardener. It promotes undercooling only, however, when the manganese content is so low that very little manganese sulfide exists. Manganese sulfide promotes a flake type of graphite, and since it exists very early in the liquid life of the metal, its presence prevents undercooling. Where manganese is absent, however, sulfide is associated with iron. Because iron sulfide is soluble in the liquid metal and does not act as a nucleant, it allows a considerable degree of undercooling to take place. Thus, one cannot consider talking about sulfur without also realizing that its effect depends purely on whether or not manganese is in sufficient quantity.

A classical example of this situation is the formation of nodular graphite. With extremely low manganese content — below 0.2 per cent — it is possible to nodularize an iron completely by adding sulfides. Iron sulfide will promote the nodular form of graphite. Manganese sulfide will destroy it.

Sulfur tends to promote undercooling, but if present as iron sulfide (which is deposited from the melt only late during the solidification) it does promote a definite grain boundary weakness because the sulfide, which in itself is brittle, tends to locate at the grain boundaries. In ordinary cast iron this danger seldom is a consideration because there always is enough manganese present to insure that all sulfur is neutralized.

Abnormally high or low sulfur often is a sign of the melting conditions and gives some idea of the type of structure that can be expected from a given cast iron. For instance, a very high sulfur iron usually is melted under poor oxidizing conditions with relatively poor coke. It would be a sign, therefore, that the types of structures normally associated with oxidized metal, which we already have discussed, could be expected in any casting made from this metal.

Fig. 11—Metal specimen at top has uniform depth of chill and uniform structure in all section sizes. Metal at bottom has nonuniform chill and structure



Often this condition is prevented by some form of desulfurization. Such desulfurization almost invariably involves a degree of deoxidation and a removal of oxides from the melt. Again, it is not so much the desulfurization that would effect the improvement, but the fact that deoxidation would go along with it.

Very low sulfur irons—that is, if they are melted that way, particularly in the cupola—indicate basic reducing melting conditions. They usually would be obtained only in very soft, high carbon, hypereutectic cast irons, which are not normally high strength materials unless they are nodularized by suitable ladle additions. Thus, metallurgically speaking, sulfur is important more as an indication of melting conditions than for its own alloying effects on cast iron.

Alloy Effect on Matrix—Elements like nickel and copper are graphitizers and tend to form pearlite—thus their addition to cast iron to prevent the precipitation of stable carbides. They usually result in a finer pearlitic matrix. Nickel, if added in very large quantities (above 10 per cent), tends to produce austenitic structure in iron.

Copper is relatively insoluble in cast iron and is used only in small amounts (up to about 1½ per cent) to produce a fine pearlitic structure. It increases the hardness of cast iron without promoting free carbides or reducing machinability.

Certain hardening elements such as chromium and molybdenum often are found in cast iron. Chromium forms stable carbides and once an iron has been whitened by the addition of chromium, it is difficult to reduce the degree of whiteness by simple inoculation or graphitization. The only way to do it is to add a graphitizer such as silicon, nickel, or aluminum in an amount sufficient to offset the effects of chromium. Small quantities of chromium, such as up to 0.2 per cent, do stabilize the pearlite, particularly in heavy sections, and can be useful in promoting a good structure in heavy castings.

As soon as chromium exceeds 0.2 per cent, however, it begins to act as a carbide stabilizer; this action should be avoided unless some wear or heat resisting qualities, due to the higher quantity of chromium, are desired. High-chromium irons are noted for their scaling resistance and hardness. In ordinary engineering irons, however, chromium is not considered an important element.

Molybdenum is one of the more important elements, from a metallurgical standpoint. It forms a relatively unstable carbide. Because of its tremendous effect on the transformation from austenite to ferrite, its chief use lies in increasing the strength of the iron. When used in sufficient amount in conjunction with nickel, manganese, or copper, or with all three, it produces an acicular structure. These acicular structures are known for their strength characteristics and higher hardness. In heat-resisting irons, molybdenum is important in that it tends to produce high creep strength.

Aluminum Additions — Several elements found in cast iron in relatively minor amounts may have a profound effect on the structure of the iron, depending on circumstances. One such material is aluminum. Aluminum is a potent graphitizer. Added in large quantity—above 2 per cent—it can confer a certain degree of heat resistance to the iron. In small amounts —under 0.1 per cent—it has the unfortunate facility of producing pinhole defects in castings.

In this connection, the quantity of titanium in the iron also is very important. Normally, these so-called trace elements are not given much consideration in ordinary engineering cast irons. It is well known that they exert a tremendous effect on the process of undercooling and, because of this, they seem to be more potent in nodular cast irons. Small amounts of tin, for example, produce a fully pearlitic iron, whereas larger quantities offset the degree of nodularity. The same may be said of titanium, which in large amounts tends to affect nodularity.

When elements such as tin and lead are present in ordinary cast irons, their effect almost invariably is a bad one, and they lead to granular and interdendritic types of graphite. Anybody who has been troubled with lead finding its way into cast iron is immediately aware of this problem and knows that the strength, machinability, and chemical properties of the material are extremely low when lead is present.

The presence of these elements, which affect undercooling, can be observed in a cast iron by the picture-framing effect that occurs on a wedge test piece. This picture-framing (Fig. 13) indicates that the metal is extremely chill sensitive where it is cooled quickly, as it is on the outside portion of a wedge.

If this type of control wedge is seen, it is wise to expect trouble with graphite structure and mechanical properties. To be safe, pig the metal rather than pour castings from it.

Fig. 12—This 36-in-diam roll casting is an example of uniform depth of chill and metal structure. Brinell hardness is uniform across entire section

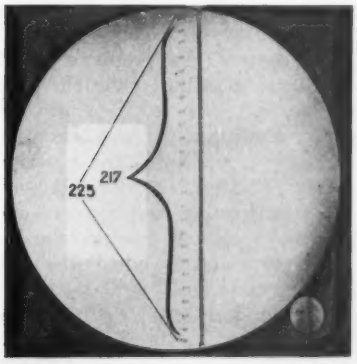


Fig. 13—Presence of elements affecting undercooling is shown by picture-framing on wedge

Editor's Note: This paper was presented at the Missouri Valley Regional Conference held at Rolla, Mo., Sept. 24-25, 1959.

• For an extra copy of this article, until supply is exhausted, use card on Page 53

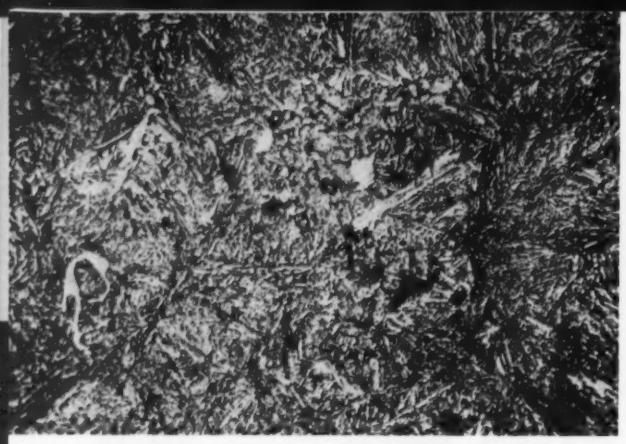


Fig. 1—When the initial matrix is martensitic, as shown here, the iron will have very high hardness

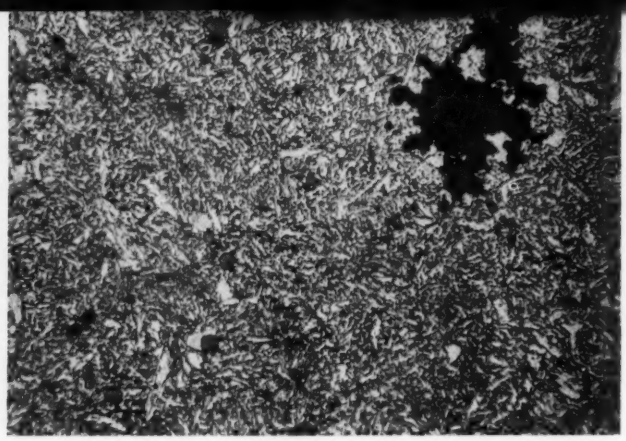


Fig. 2—While tempering at a low temperature, the martensite will change into a matrix such as this

Heat Treatment of

PEARLITIC MALLEABLE

This article, a chapter from Malleable Iron Castings, a new handbook published by the Malleable Founders Society, discusses effect of the heat treating cycle on the properties of pearlitic malleable iron

● IN MOLTEN IRON, carbon furnishes high fluidity, making it possible to cast thin and intricate shapes into final form. To assure excellent properties in the final product, none of this carbon is permitted to come out as flake graphite during solidification. Instead, it is retained as iron carbide, which, because of its hardness and brittleness, must be subsequently converted by the malleablizing process into its basic compounds—ferrite and temper carbon.

In the form of compact nodules, the graphite offers but little discontinuity to the tough ferritic matrix. Furthermore, the graphite nodules serve the very beneficial purpose of lubricating cutting tools, a fact which accounts considerably for the extraordinarily high machinability of malleable iron.

Carbon can be made to contribute additional unique properties to malleable iron if a small controlled quantity (0.3 to 0.9 per cent) is retained as finely distributed iron carbide in the matrix. By virtue of the high strength and hardness of the carbide itself, the over-all strength and hardness of the castings may be increased over those of standard (ferritic) malleable iron to a degree roughly proportional to the amount of combined carbon remaining in the finished casting. Malleable iron that contains purposely retained eutectoidal carbides or low-temperature transformation products is called pearlitic malleable iron, or often just pearlitic malleable.

Influence of Carbides—The nature of the carbides and their abundance, size, and distribution directly affect the properties of the material. If, through quenching, the initial matrix is martensitic (Fig. 1), the iron will have very high hardness (550+ Bhn). Upon tempering at a relatively low temperature (800 or 900° F) the martensite will transform into a matrix like that shown in Fig. 2. Such an iron will have very high strength (125,000 psi tensile and 110,000 psi yield), hardness (300 Bhn) and wear resistance, but its ductility, machinability, and impact resistance will be below that of pearlitic malleable irons treated at higher tempering temperatures.

On the other hand, if the carbides are spheroidal in shape and uniformly distributed (Fig. 3), the iron will have better ductility and machinability than a laminar pearlitic malleable at a comparable hardness level. Matrices consisting of a dense pattern of finely spheroidized cementite will respond most rapidly to hardening treatments which are more fully covered later.

In general, the properties of a particular pearlitic malleable iron are dependent on (a) the chemistry and processing of the base iron from which it is made, (b) the presence of added alloys, (c) the ability of the heat treating equipment to obtain and accurately maintain the desired temperatures, and (d) the heat treating cycle itself.

To elucidate, a high silicon con-

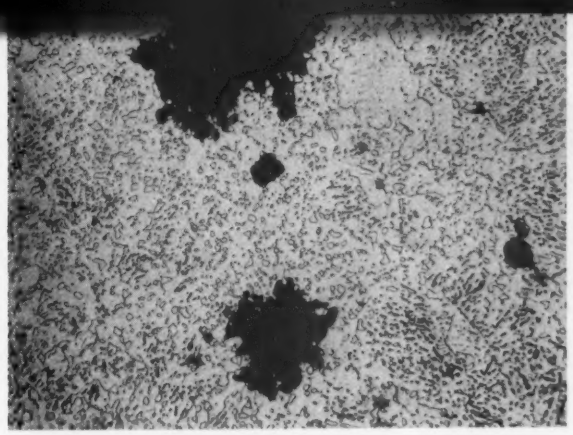


Fig. 3—The carbides shown here are spheroidal in shape and are uniformly distributed

IRON

tent will hasten first-stage graphitization, but will render the iron more sensitive to slight changes in the tempering cycle. White irons that are low in total carbon generally produce pearlitic malleables of somewhat higher ductility than will the irons of high carbon content. White irons melted under severely oxidizing conditions will usually have a low nodule count, and so a longer first-stage graphitizing cycle will be necessary. Very high nodule counts in unalloyed pearlitic malleable irons tend toward nonuniform response to tempering.

Chemical elements may be added to the molten base irons for such purposes as controlling the shape, compactness, and distribution of the temper carbon nodules, permitting heavier mottle-free sections to be cast, hastening first-stage graphitization, strengthening the matrix, facilitating the heat treatment, providing better resistance to corrosion, diminishing or eliminating the susceptibility to temper embrittlement, increasing hardenability, affording structural stability to elevated-temperature service conditions, retarding graphitization during tempering, or a combination of these.

Equipment a Factor—The type of heat treating equipment available may decide the method of making pearlitic malleable iron. For example, a plant having only large batch type ovens would probably employ alloying, since it would be impossible to obtain uniform air quench of a load of several tons of unalloyed iron, and liquid quenching would not be feasible. A company whose pearlitic malleable production is only a small proportion of the total malleable output would probably employ small furnaces, which would lend flexibility to the installation without huge capital investment.

Because of differences in base iron, in the nature of the castings made, in the volume of production, in existing heat treating facilities, and in properties required of the castings, there are probably no two plants that manufacture pearlitic malleable iron in precisely the same way. However, all the various methods for producing pearlitic malleable castings, whether from white iron of standard malleable composition or from alloyed iron, have one requirement in common, namely, that the massive (or primary) carbides be completely eliminated. This is merely another way of saying that completion of first-stage graphitization is a prerequisite for all ways of manufacturing pearlitic malleable castings.

Table I is a breakdown of the several common practices in commercial usage. Each of the six possible steps in the heat treatment of pearlitic malleable iron is reviewed below, followed by a discussion of each of the eight processing methods listed in Table I.

First-Stage Graphitization — As stated above, all white irons destined to become pearlitic malleable castings are heated to a high enough temperature within the austenitic range and held sufficiently long at that temperature for all massive carbides to decompose (i.e. graphitize) and for equilibrium to prevail. The cycle is essentially the same as the first stage of a full malleablizing treatment. Irons alloyed with certain elements or combinations of elements may require a somewhat extended cycle to complete graphitization.

Second-Stage Cycle—If the iron is to be fully malleablized before conversion into pearlitic malleable, it

TABLE I—Commercial Processes for Producing Pearlitic Malleable Iron

METHOD	UNALLOYED					ALLOYED		
	Quenched and Tempered			Reheat-Treated Malleable Iron		Quenched and Tempered		Furnace Cooled Mall. Cycle
	Air Quench	Liquid Quench		Air Quench	Liquid Quench	Air Quench	Oil Quench	
	I	II	III	IV	V	VI	VII	VIII
Designation	AT	AROT	OT	MRA	MROT	Al-A	Al-O	Al-M
First-stage graphitization	X	X	X	X	X	X	X	X
Normal second-stage cycle				X	X			X
Air quench from 1500° F or higher	X	X		X		X	X	
Reheat into austenitic range		X		X	X		X	
Liquid quench from 1450° F or higher		X	X		X		X	
Temper 450-1350° F	X	X	X		X	X	X	
Matrix	Lamellar pearlite and/or spheroidite	Martensite, tempered martensite, or fine spheroidite		Lamellar pearlite	Martensite, tempered martensite, or fine spheroidite	Coarse lamellar pearlite and/or spheroidite	Tempered martensite or fine spheroidite	Coarse lamellar pearlite

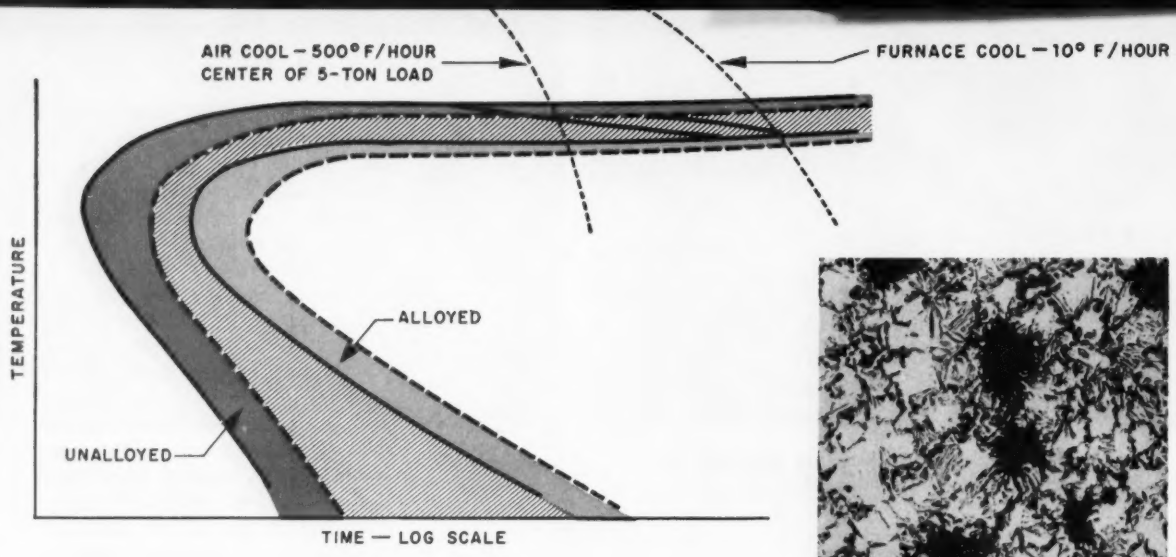


Fig. 4—Time-Temperature-Transformation (T-T-T) curves for pearlitic malleable iron. Note that alloying shifts the curve to the right

must be put through a complete second-stage cycle. This is common practice for plants which may require only small or moderate tonnages of pearlitic malleable made to a number of different specifications. In such plants all castings initially are given the same full malleablizing anneal, resulting in a wholly ferritic material. Then only those castings that are to be transformed into pearlitic malleable are reheat treated in a short special cycle that will develop the desired recombination of carbon.

Other plants which have appropriately alloyed their pearlitic malleable castings may process them right along with their standard malleable production in a normal annealing cycle. The alloying sufficiently retards second-stage graphitization in the treated castings so that the desired secondary carbides, usually in the form of laminar or partially-spheroidized pearlite, remain in the matrix of the castings.

Air Quench—The air quench is an economical means for cooling castings fast enough through the eutectoid range to retain secondary carbides throughout the matrix. The quantity of pearlite so retained will depend on the temperature at which the quench initiates and upon the rate at which the castings are cooled by the air. High quench temperatures and fast cooling rates result in greater amounts of retained carbide. An air blast directed on a thin layer of castings will produce high cooling of the work and consequently the retention of more and uniformly distributed pearlite.

On the other hand, a large load of castings brought out into still air will cool much more slowly because of the greater amount of heat that must be dissipated from the mass. In the work at the heart of the load and in heavy-sectioned castings there will be less total pearlite, and partial graphitization will develop ferritic areas immediately adjacent to the temper carbon nodules. Thus, the use of an air quench as the sole quenching medium for treating large batches of unalloyed castings is quite impractical. However, the air quench can be very satisfactorily incorporated in cycles of continuous furnaces that discharge only a few hundred pounds of castings each push.

Suitable alloying of irons to be air quenched will shift the T-T-T curve sufficiently to the right to assure a full pearlitic matrix on air quenching even large loads of castings. This is illustrated by Fig. 4. After air quenching, alloyed irons not only possess a more uniform matrix, which is free from "bulls'-eyes," but they also have a finer carbide structure, which responds faster to subsequent tempering of spheroidizing treatments.

Reheating — Fully malleablized castings that are to be converted into pearlitic malleable have to be reheated to a high enough temperature above the lower eutectoid (Ac_1) to dissolve a controlled quantity of carbon from the graphite nodules so that there will be sufficient combined carbon in the structure after subsequent quenching to develop the desired properties.

The higher the temperature the faster will be the reaction and the greater will be the amount of carbon combined. Excessively high reheat temperatures, however, generally are avoided because of fuel economy, the greater need for protective atmospheres, and the increased possibility that quench cracks may develop.

Accurate regulation of the time-temperature reheat cycle permits control of the carbon that is recombined. Reheating to some temperature within the eutectoid range for too short a time to effect homogenization results in carbon being combined only in the vicinity of the graphite nodules and at the grain boundaries. Fig. 5 illustrates a pearlitic malleable, after tempering, that was made in this way.

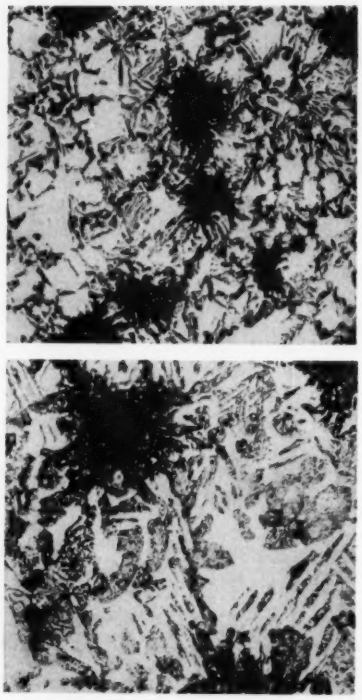


Fig. 5—Pearlitic malleable iron made by reheating fully ferritic malleable iron above the lower eutectoid temperature, followed by liquid quenching, tempering Top enlarged 150X, bottom 500X

Castings to be subsequently air-quenched are generally reheated to a higher temperature than are those to be liquid quenched.

Liquid Quench — If a higher quenching rate than is possible by using an air-quench alone is desired, a liquid medium must be employed. Water and brine solutions ordinarily are too drastic and are seldom utilized for pearlitic malleable production. Through the addition of about one-half per cent carboxyl methylcellulose to water the quench rate is retarded sufficiently to approach that of the common mineral oils. Such a solution is nontoxic and presents no fire hazard, but it must be kept well agitated or the quenching results will not be uniform.

Oils, having roughly one-third the quenching speed of water, are used widely by manufacturers of pearlitic malleable castings. The amount of martensite formed on quenching will depend on the quenching speed of the particular oil used, the temperature from which the work is quenched, the time at that temperature, the thickness of the castings, and the chemistry of the iron.

Liquid-quenching is utilized widely in the production of the very high-strength and high-hardness pearlitic malleable irons. It also offers certain advantages over air quenching. A liquid-quenched matrix is uniform and very fine-grained, so it responds rapidly to tempering. Furthermore, at identical hardness levels, liquid-quenched pearlitic malleables tend to have higher yield strengths than do irons by air quenching. This is shown in Fig. 6.

Isothermal quenching of malleable irons is quite feasible. Fig. 7 illustrates the properties obtainable by isothermally quenching standard tensile test specimens from a 1600° F austenitizing temperature into salt baths at various temperatures. As may be seen, the properties are dependent on the temperature at which isothermal transformation occurs and on the presence of elements that increase hardenability.

Tempering — Except for those cases where high hardness is desirable and where low machinability and impact resistance are not objectionable, it is comomn practice to temper the air or liquid-quenched irons. Those having coarse pearlitic structures (such as result from air cooling) are tempered at some relatively high temperature in the range of 1200 to 1320° F usually to bring about spheroidization or partial spheroidization of the pearlite. The time during which unalloyed castings are held at this temperature is fairly critical, because graphitization also occurs during tempering, so that some combined carbon is being removed. Other factors which affect the tempering cycle are graphite distribution, chemistry of the iron, and fineness of the as-quenched pearlite. For example, a high nodule count and high silicon content favor graphitization. On the other hand, certain carbide-stabilizing elements (manganese, molybdenum, sulfur) may be added for the purpose of permitting the spheroidizing reaction to predominate over graphitization, which can be held to a low or almost negligible level in this way. Although somewhat longer tempering times usually are necessary to bring about spheroidization in alloyed irons, it is possible to treat loads of several tons and castings of widely different section thickness and still obtain greater uniformity of the pearlitic matrix than is possible with similarly handled unalloyed work.

Irons that have been liquid-quenched to give a martensitic structure may be tempered at any temperature from about 450° F up to the lower eutectoid to develop a matrix of any of the tempered martensites or of spheroidite. Because of the high response of liquid-quenched irons to tempering, accurate control of the time-temperature cycle is imperative. Tempering at temperatures in the low side of this range will result in high-strength, high-hardness pearlitic malleable. The higher the draw temperature the softer the metal becomes and the more the properties approach those of the air-quenched pearlitic malleables.

● For an extra copy of this article, until supply is exhausted, use card on Page 53

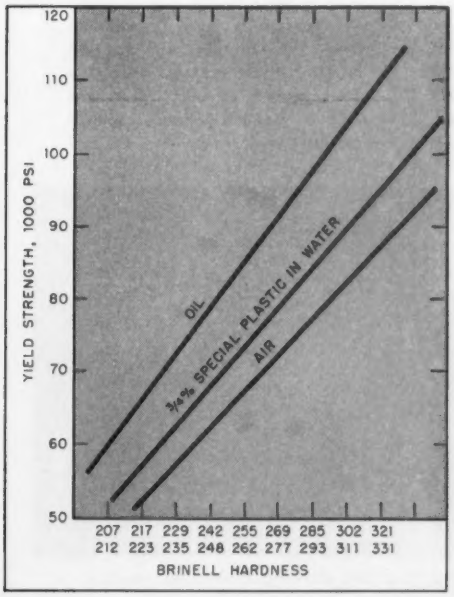


Fig. 6—Relationship between yield strength and Brinell hardness as affected by quenching medium and rate

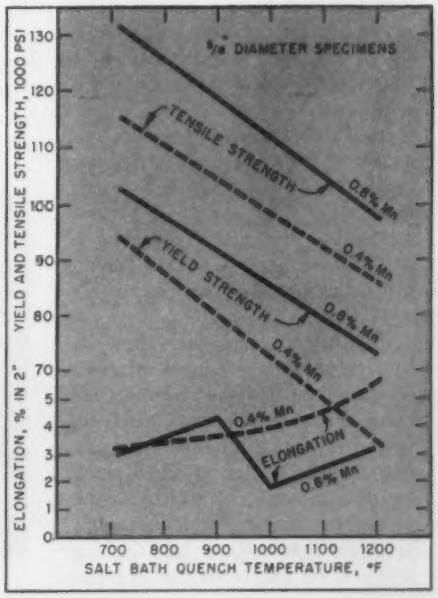


Fig. 7—Typical mechanical properties obtainable by isothermally quenching standard tensile test specimens at various temperatures. Standard malleable iron is the dotted line and the solid line is pearlitic malleable iron

Questions and Answers

Customer complains iron castings are too hard . . . Height of the cupola is not standardized . . . Suggests change in gating system to eliminate occurrence of shrinkage areas . . . Producing bushings . . . High carbon pickup

Casting Hardness Is Too High

We are making some castings about ¼ in. sections with flanges around ¾ in. thick. They are made by addition of ferroalloys to a base iron containing 2.20 to 2.40 per cent Si, 3.40 to 3.50 per cent TC, 0.60 to 0.80 per cent Mn, 0.095 per cent S, and 0.125 per cent P. Amount of ferroalloys is specified as 0.50 to 0.60 per cent Cr and 0.20 to 0.40 per cent Mo. Occasionally we receive a specification for 0.75 per cent Cr and 0.75 per cent Mo. Both compositions are supposed to have a Brinell hardness of less than 228. Customer complains of high hardness. What can we do to hold the desired Brinell?

Since you do not mention what hardness is being obtained on the flange section, we assume that you do not have equipment in the foundry to determine it. We suggest you purchase a Brinell hardness indicator and run some tests on 1.2 in. test bars and the flanges so that you have some idea of the correlation.

Also make some wedge bars and correlate the chill depth with the test bar and flange hardness values. From those data you can make adjustments through addition of graphitizing agents in the ladle to bring the hardness within the desired range.

It would be our guess that the iron containing the lower amounts of chromium and molybdenum will come within the desired Brinell figure with slight additions of graphitizing agents. More difficulty will be had, however, with the higher chromium and molybdenum alloy. It might be well to ask the customer if he has correlated hardness with machining. It often happens that higher hardness material machines as well as that with a lower value. That, of course, assumes that sturdy machine tools as well as properly sharpened cutting tools are being employed.

Determining Cupola Height

Can you supply us with information on the heights from the tops of the tuyeres to the bottoms of the charging doors for cupolas 42 and 48 in. in diameter?

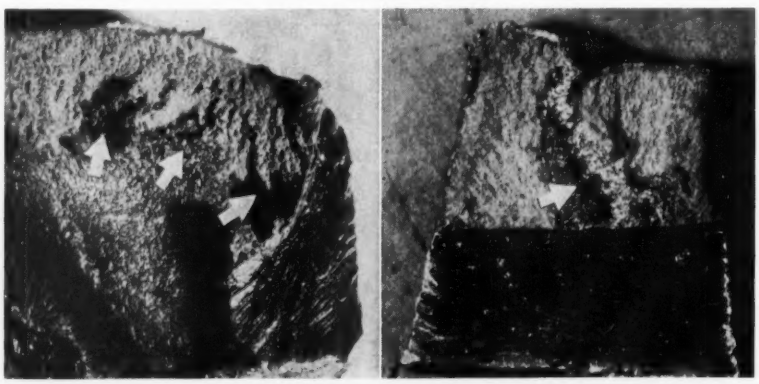
So far as we know, there is no standard dimension for establishing the distance between the tuyeres and the charging door. The portion of the cupola above the melting zone, in addition to forming a container for the succeeding charges of coke and iron, functions as a heat exchanger whereby some of the sensible heat in the combustion gases is transferred to the descending materials.

This transfer of heat aids in improving the melting efficiency of the cupola but, like many recovery systems, it has its limitations. Hence, although we do not know how it was derived, the general consensus is that satisfactory results are obtained when the height between the tuyeres and the charging door is 16 to 22 ft.

Formulas for establishing the height from tuyeres to charging door include those attributed to Vial of 2D plus 5 ft for cold blast, and 2¼D plus 5 ft for hot blast cupolas; to Wagner who developed the formula of 6½D; to Karnaukhov who indicated a range from 3.345D to 7.93D (max), and to Buzek who recommended 5.1D to 6.17D. The last three formulas are from Hurst's book, *Melting Iron in the Cupola.*

Shrinks Occur in Castings

We are forwarding for your examination a small aluminum bronze casting which shows a shrink or blow on the inside near the tip, and we would like to know how to prevent the defect. Pattern is a matchplate containing 10 castings. Sand is synthetic with a moisture content of 3.8 to 4.1 per cent, and a permeability of 41. Core is resin-bonded sand of 85 AFS grain fineness. The defect also occurs when a copper chill is made in the core or when a large vent is made through the core. Alloy contains 3.50 per cent Ni, and 10 per cent Al. Metal has been poured at 2050, 2100 and 2200° F without eliminating the trouble.



Enlargements of fractured tip and lug showing shrinkage areas

Although the location of the defect and its surface appearance suggest that the trouble is caused by a blow, your reference to changes in the core indicate otherwise. That was confirmed by fracturing the casting in the affected area as well as in other areas. As shown in the accompanying macrographs of the fractured tip and lug or base sections, there is no doubt that the defects are shrinks even though difficulty was encountered in obtaining suitable focus with the camera. Enlargement is between 4 and 5 times actual size. It should be pointed out that the defective lug or base section is that opposite the one to which the present gate is attached.

Since shrinkage areas indicate lack of suitable feeding, the gating system must be changed to eliminate the difficulty. While you did not supply information on the position of the castings, we assume that you are following the practice usually employed with aluminum-bearing, copper-base alloys of gating at the bottom. Therefore, before making any major change in the present pattern, we suggest you make the addition shown in B in the accompanying sketch of present and proposed gating.

The addition is a ¼-in.-square extension of the gate to and slightly beyond the projection opposite that carrying the present gate. That will permit metal to flow up two sides instead of only one as at present, and should eliminate the shrinkage difficulty. Possibly, you may have to use a small chill at the tip of the core, but it is suggested you first try the core without.

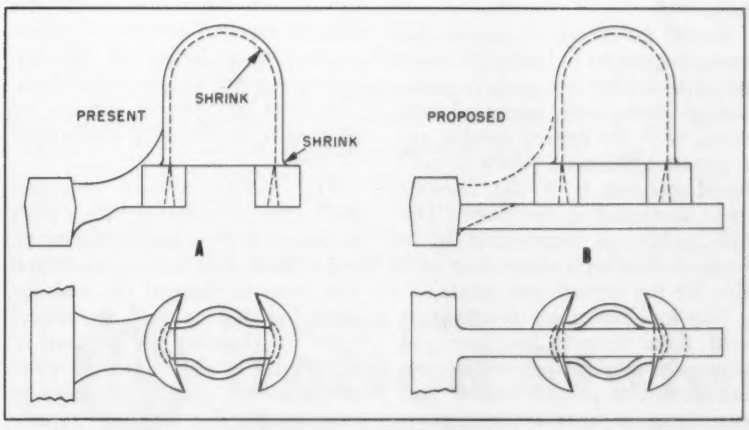
Mold Bushings in Green Sand

We manufacture a large quantity of bronze bushings in our foundry in Cuba, using natural molding sand and drying the molds in ovens. Can you supply us with information on a green sand mixture which will eliminate drying the molds?

Since you do not give any information on the characteristics of the sand you are using, your statement that the molds are baked indicates that it probably is a fine-grain sand with high clay content which cannot be used in the green state due to low permeability. Possibly that sand might be opened up by blending with coarser sand, but that requires knowledge of the grain distributions and clay contents of the sands involved. Also, considerable work and time are involved in developing the most suitable combination, and you probably would be further ahead by replacing the old sand with a new one.

This move is not quite as easy as it appears, however, since it is advisable to experiment with small batches of different kinds of sand to determine which will be most satisfactory for your type of operation. We suggest you try a natural molding sand with a grain fineness of 140 to 150, using a moisture content around 6 per cent, and observe the results obtained. The same should be done with finer and coarser sands, and on the basis of results a decision can be made.

If you are interested in formulating a sand from a nearly clay-free type and adding a bonding material, you might try one of 100 to 110 grain fineness mixed with 7 to 8 per cent southern bentonite and 3 to 4 per cent moisture. That mixture is reported to result in a sand with a green strength around 16 psi and a permeability of 28 to 30. It should be rammed to give a high mold hardness. That practice should not cause blows.



Sketch showing present and proposed methods of gating the casting

Carbon Pickup Is Too High

In our foundry in India we made some stainless steel castings and ran into difficulties. The raw material is stainless scrap of 18-8 quality obtained from sheet metal workers which is melted in graphite crucibles in pit furnaces without addition of fluxes or other materials. The resulting castings were very hard and difficult to machine, even with carbide-tipped tools, and could not be threaded with taps and dies. Also we found pinholes in the castings, and since they were for pressure applications, that condition is not permissible. Can you suggest how we can make suitable castings?

Use of graphite crucibles for melting steel, whether plain carbon or alloy type, is not satisfactory due to the high carbon pickup which results. If it is necessary to employ the crucible process, you will have to obtain clay crucibles similiar to those employed when large quantities of steel were made by the crucible process.

As a temporary expedient you might try lining the graphite crucible with a high-quality refractory clay mixed with crushed refractory brick, zircon sand, or silica sand.

Another possibility is a lining composed of 100 lb zircon sand, 3.25 lb fireclay, 1½ pints sodium silicate (41° Be), and 3½ pints water. Perhaps a lining of calcium-aluminate refractory cement might serve. Such linings should be thoroughly dry before the crucible is used, and preferably by placing in the furnace and gradually raising it to the highest possible temperature.

Best corrosion-resistance properties of the 18-8 alloy are obtained when all the carbon is in solution and no chromium carbides are precipitated in the grain boundaries. That condition can be obtained by heating the castings to 2000 to 2100° F and quenching in water,

oil, or air depending on casting form.

With reference to the pinholes, it is difficult to determine whether they are due to a sand-metal reaction, or to gas or hydrogen in the molten steel. We suspect the pinholing may be due to the latter condition, and suggest trying the addition of a small amount of ferro-selenium to the melt. Suggested addition is 0.0125 per cent selenium.

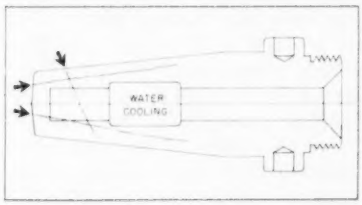
Glass Mold Plungers Crack

We are operating a small gray iron foundry and melting about 1520 kg per day. Main production is in small castings using natural sand and permanent molds. The permanent molds are used for producing small objects such as plungers used in glass pressing machines. Our trouble is that some of the plungers crack after extremely short operating periods. Analysis of the iron shows 2 to 2.2 per cent Si, 0.56 per cent Mn, 0.116 per cent S, 0.375 per cent P, 1.6 per cent Ni, and 0.50 per cent Cr. Our charges are composed of pig iron, return scrap, auto cylinder blocks and auto crankshafts. The pig iron contains 2 to 3 per cent Si, 0.75 per cent Mn, 0.30 per cent P, and 0.055 S. A drawing of one of the plungers indicating the location of cracks is enclosed. The glass temperature is 1110° C, and we will appreciate information on the cause of the cracks.

Undoubtedly the failure of the alloy cast iron plungers used in forming molten glass is due to lack of resistance to thermal shock, but why difficulty should be encountered with some of the plungers and not with others will require some investigation on your part. Some years ago Bruckner and Czyzewski made a study of gray iron suitable for glass molding and concluded that best results were obtained when the structure of the iron showed a matrix composed of free ferrite, spheroidized pearlite, and lamellar pearlite.

The composition of the iron was similar to that you are using except that it also contained 0.50 per cent Mo. Actual composition given was 2.40 per cent Si, 0.66 per cent Mn, 1.25 per cent Ni, 0.45 per cent Cr, 0.50 per cent Mo, and 3.44 per cent TC. Additionally the desired structure was obtained by annealing at 1450° F for 4 hr. The specimens were cast in the form of blocks 6 x 9 x 2½ in. with the 6 x 9-in. face against the chill.

It would appear to us that if most of your plungers provide satisfactory life, there is some variation in analysis, pouring temperature, etc., in those that do not give desired results. As you undoubtedly know, differences occur with difference in pouring temperature as well as in mold temperature. We suggest you examine the structure of the plungers which have cracked, and compare them with those which provide satisfactory service life. From such observations you should be able to determine the direction in which to proceed to eliminate the problem.



Arrows indicate where cracks occur

Make Matchplates in Plaster

Several years ago in an issue of FOUNDRY information was presented on the pressure-casting of aluminum matchplates. We now are interested in that procedure, and will appreciate information on the article or the process.

Several articles have appeared in FOUNDRY describing pressure-casting of matchplates. They include "Pressure Casting Aluminum Matchplates"—July, 1945; "Pressure Casting Matchplates"—April, 1947, and "Pressure Casting Aluminum Matchplates in Plaster Molds"—July, 1948.

Briefly, the practice is to make the requisite quantity of half molds from the pattern. They are made in metal casting plaster and assembled face down, with the desired spacing, on a glass-topped table. Glass is preferred because it is flat, smooth and not affected by the plaster. The half molds are surrounded by a frame or flask with dimensions suitable for the desired matchplate.

The half molds are weighted to hold them securely in place and then more of the liquid metal casting plaster is poured around and over them to form an integral or single mold. If the plate is to be single face, a flat-back of plaster is made to form the cope. If the plate is to be double face, either of two procedures may be followed.

One method is to make a set of half molds from the opposite half of the pattern if unsymmetrical, place them on top of the mold just made by use of plaster replicas of the pattern, and pour plaster around and over them as in the first instance.

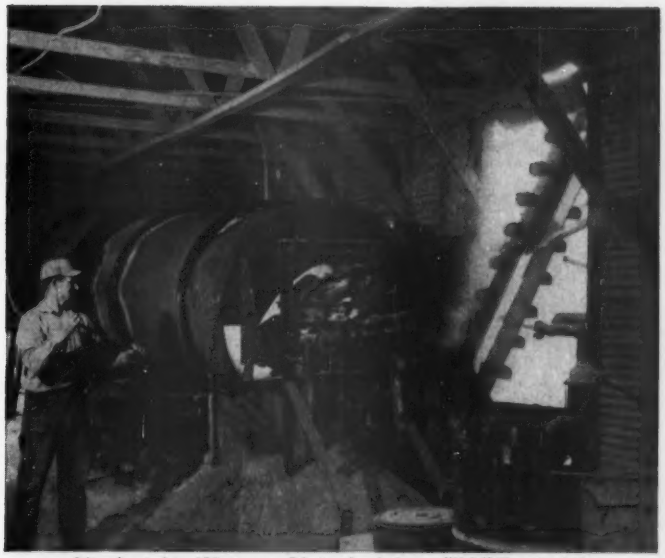
The other and shorter method is to place plaster replicas of the pattern in the cavities in the mold and pour the plaster over them. In these various operations separating or release agents such as soap solution, oil-wax compounds, etc., are used so that the several parts may be separated.

While the molds are in the damp or moist state, the gating system for the patterns on the matchplate, as well as that to feed or pour the matchplate, are tooled with gouges, etc. Then the cope and drag plaster molds are placed in an oven for thorough drying. Usual practice is to dry at 400 to 600° F for 10 to 14 hours. While still hot, the molds are removed from the oven and assembled. The two halves are separated with asbestos board strips of the same thickness as the desired plate. End strips or spacers are contoured to form the matchplate ears for affixing the locating pins or bushings.

Molds are clamped together carefully to eliminate the possibility of springing, and then the pressure chamber which will hold the molten metal is placed over the sprue with a thin asbestos disk about 1/16 in. thick between the two openings. The pressure chamber is cylindrical and of such dimensions that it will hold the required quantity of molten metal, and is flanged at the top so that a cover can be clamped on. The cover contains an opening for attachment to the shop compressed air line.

The chamber is lined with thin sheet asbestos or coated with a wash to prevent any sticking of the metal, and is filled with molten aluminum. The cover is clamped on, and the metal allowed to cool to around 1130° F. Then an air pressure of 4 to 6 psi is applied to the pressure chamber, causing the metal to puncture the disc and flow rapidly into the mold cavity.

HOT MATERIALS ELEVATOR BELT



Silica heated to 450 degrees F being loaded onto "U.S." Elevator belt.

"U.S." Elevator belt carrying hot silica up to and discharging it into chute.

"Terrific heat, terrific weight, high abrasion . . . all combine to severely tax elevator belts. But this U.S. Rubber Belt has been on the job 3 times longer than any belt previously used," says co-owner J. C. Barry of Barry & Barry Sand Co. (Silsbee, Texas) producers of foundry, chemical and specialized sands.

J. C. and J. W. Barry watch the hot silica being funneled into loader equipped with "U.S." loader belt.

"We have two U.S. Rubber elevator belts here," he adds. "We need belts that will last a long time, which means belts that are not bothered by terrific heat (up to 450 degrees F.) terrific weight, plus the abrasive action of sand. So far, each of these belts has outlasted the belts of other makes while showing no signs of wear. *These belts never fail us...no lost production, no downtime.* We are very satisfied. They do our job best."*

It is performance such as this that has made U. S. Rubber the largest manufacturer of conveyor and elevator belts.

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*This installation was handled by "U. S." Distributor Behring, Inc., Beaumont, Texas.

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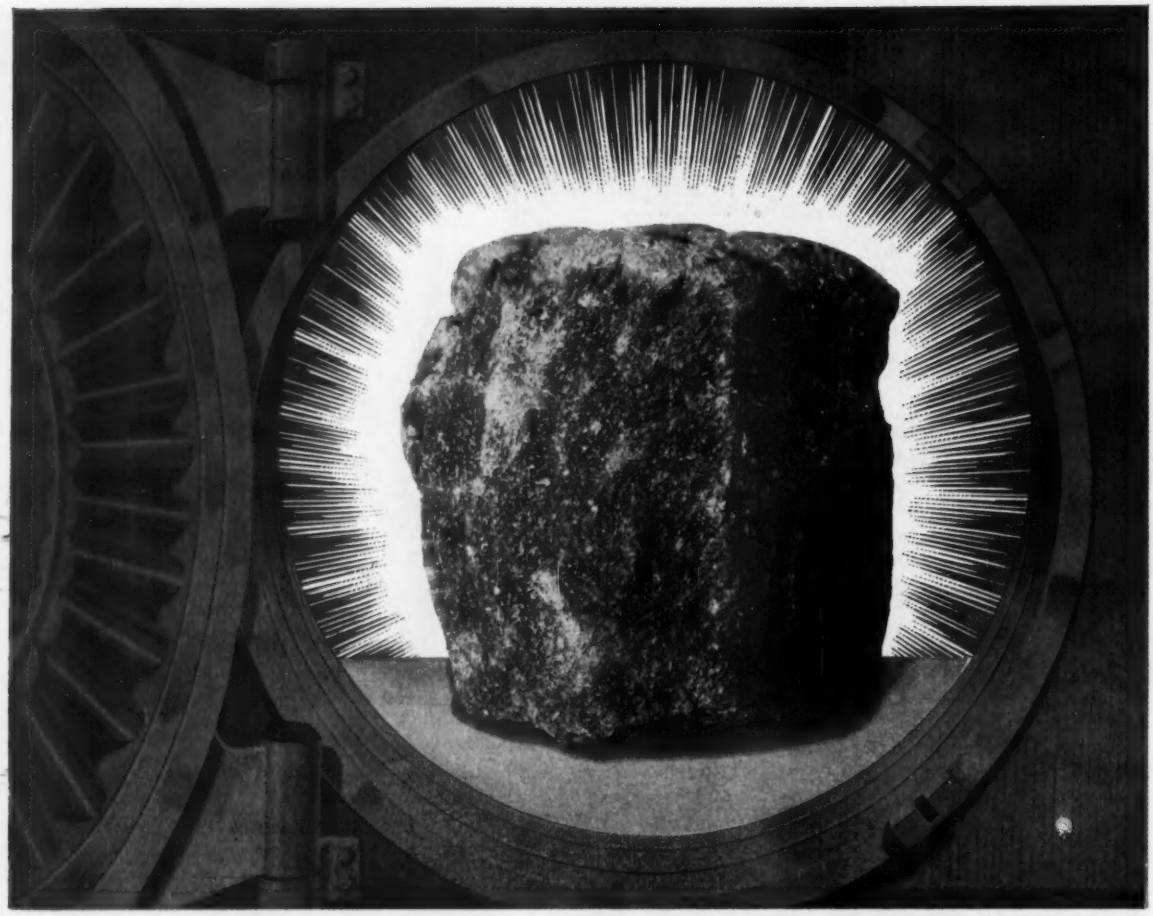

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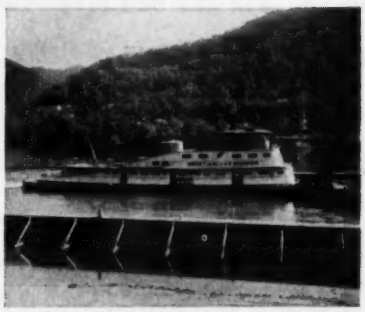

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What's New in Equipment and Supplies

WELDER GOGGLES

Seesall Cover-Spec goggles are said to give comfortable fit, indirect ventilation, flexible leather pro-

tective nose guard, and lightweight construction. Because of the angled lenses, the wearer sees clearly with only a slight tilt of his head. This design eliminates neck and shoulder fatigue.—**Glendale Optical Co.**, 600 W. Merrick Rd., Valley Stream, N. Y.

For More Details Circle No. 456—Page 53

INDUSTRIAL COMPRESSORS

Ease of installation in minimum space is the outstanding feature of industrial compressors. Units are completely enclosed and have no exposed belts or couplings. Compressors are lightweight, compact, and need only a small outlet. Either air or water-cooled units are available, in 20 to 125 hp.—**Davey Compressor Co.**, Myers Avenue, Kent, Ohio.

For More Details Circle No. 457—Page 53

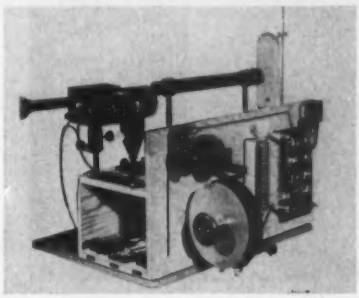
SCHEDULE BOARD

Memo Flex visual control or schedule board features simplicity, flexibility, and ease of operation. Fifty flexible plastic strips are held in the board at the edges. They slide up and down and snap in and out for easy arrangement. Entries or notations are made directly on the strips with a grease pencil and can be erased with a cloth or tissue. —**Garrison Machine Works Inc.**, 519 Bannock St., Dayton 4, Ohio.

For More Details Circle No. 458—Page 53

PYROMETER CALIBRATOR

Model 107 optical pyrometer calibrating set is designed to permit accurate and simultaneous calibration of any two optical pyrometers. Set is furnished as a total package ready to use and complete with certificate of calibration from equipment calibrated at the National Bureau of

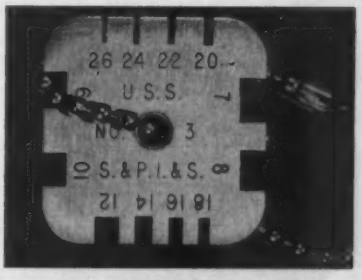


Standards. Wide-filament, strip-type lamp can be adjusted by step and vernier rheostats to any desired temperature from 1400 to 4200° F.—**Pyrometer Instrument Co. Inc.**, Portland and Delford Avenues, Bergenfield, N. J.

For More Details Circle No. 459—Page 53

STEEL GAGE

Gage-It steel gage is machine tooled and calibrated in 12 gages from 26 to 7. Made of stainless steel, it fits on a key chain. Instru-



ment is ideal for shopworker, foreman, or executive.—**Columbus Hydraulics**, Columbus, Nebr.

For More Details Circle No. 460—Page 53

PLASTIC REPAIR KIT

Industrial repair kit contains liquid and paste plastic compounds which solidify to adhere and lend strength to fractures, tears, holes, or dents in metal, wood, plastic, concrete, ceramics, and other materials. Each kit also contains fiberglass cloth and necessary mixing tools and brushes. Instructions are included.—**Taylor & Art Inc., Plastics**, 1710 E. 12th St., Oakland 6, Calif.

For More Details Circle No. 461—Page 53

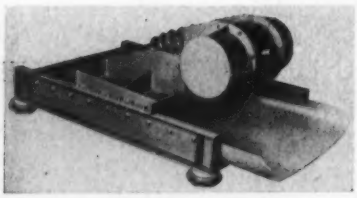
AIR CYLINDERS

Stainless steel air cylinders contain double end rods. The 1 1/16-in. bore, double-acting cylinders are available in stroke lengths to 18 in. Rolled-in construction makes the cylinder compact and inexpensive. —**Bimba Mfg. Co.**, 101 Main St., Monee, Ill.

For More Details Circle No. 462—Page 53

VIBRATING FEEDERS

Forty-nine new sizes, in two motor capacities, have been added to a



line of motorized counterweight vibrating feeders. MC twin motor feeders include sizes with capacities from 275 to 1700 tons per hr. Single motor feeders have capacities from 5 to 525 tons per hr. Size ranges now include feeder lengths from 4 to 14 ft, trough widths from 1 to 6 ft, and capacities from 5 to 1700 tons per hr.

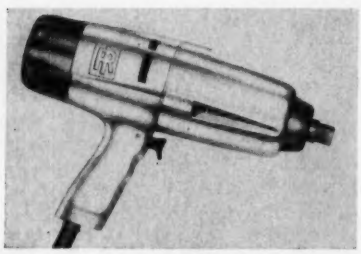
Feeders consist of a trough and motorized vibrator drive, mounted directly to the rugged channel frame. Counterweights are mounted on a double-extended shaft. Feeders are available either floor-mounted or cable-suspended. Illustration shows a floor model with single motor-vibrator drive. — **Link-Belt Co.**, Prudential Plaza, Chicago 1, Ill.

For More Details Circle No. 463—Page 53

HEAVY DUTY IMPACT TOOL

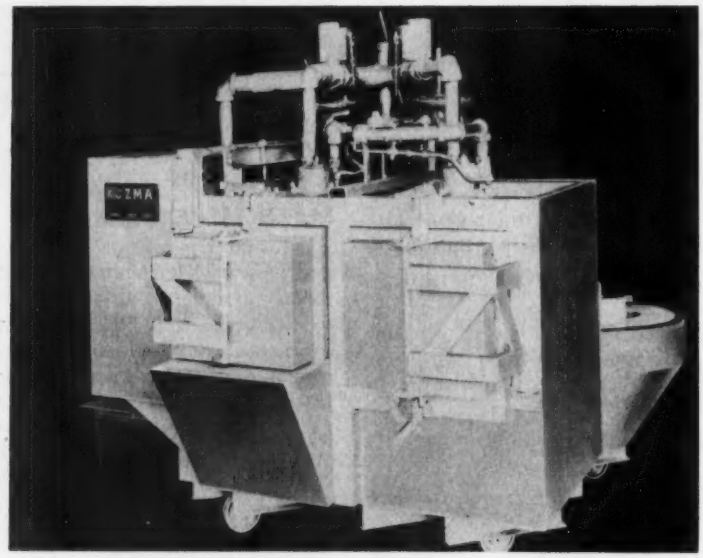
Size 8U heavy duty electric Impactool has been redesigned to give more power. Power, good balance, and a palm-fitting handle make it possible to use the tool over long periods without undue fatigue. Socket driver is T-type to improve power transmission. New model has 6-amp universal motor, replaceable socket retainer, nylon trigger, and reinforced rubber-nosed hammer case.

Tool has 5/8-in. square drive, overall length of 11 7/8 in., and a side-to-center distance of 1 11/16 in. Unit runs with a free speed of 1700 rpm and delivers 1725 blows per minute when impacting.—**Ingersoll-Rand Co.**, 11 Broadway, New York 4, N. Y.



For More Details Circle No. 464—Page 53

Melting Furnace Insures High-Purity Aluminum



Model RSHCH aluminum melting furnace is said to produce low porosity aluminum castings. Charging method and subsurface metal flow principles of design almost eliminate hydrogen pickup and oxide inclusions. Carefully engineered position angle of charging knee prevents aluminum ingot from entering the bath until it has reached a plastic state. Preheating of ingot is about 70 per cent of the melting point at which the ingot deforms and slides into bath with no increase in surface area. Zone dividing walls extend below surface of the bath to eliminate transfer of surface oxide film to dipwell.

Radiant panel firing provides fast, uniform heat distribution, eliminates flame impingement, and reduces over-all fuel costs (approximately 1000 Btu per lb melted).—**J. A. Kozma Co.**, 2471 Wyoming, Dearborn, Mich.

For More Details Circle No. 494—Page 53

COMPRESSED AIR DRYER

Two-stage, nonregenerative air dryer combines both mechanical and chemical methods for removal of water and moisture vapors, providing a dewpoint as low as −20° F. First stage uses a helical centrifugal chamber as a prefilter for the air stream and leaves only the vapor content to enter the desiccant bed. The desiccant is a polychemical base in small bead form and slowly dissolves during the process, requiring addition of the beads only twice a year. Air dryers are available in 12 standard models with capacities up to 2250 cu ft free air per min. Standard working pressures are 150 and 200 psi.—**General-Erie**, 1702 Peninsula Dr., Erie, Pa.

For More Details Circle No. 465—Page 53

VISIBLE LEVEL TANK GAGE

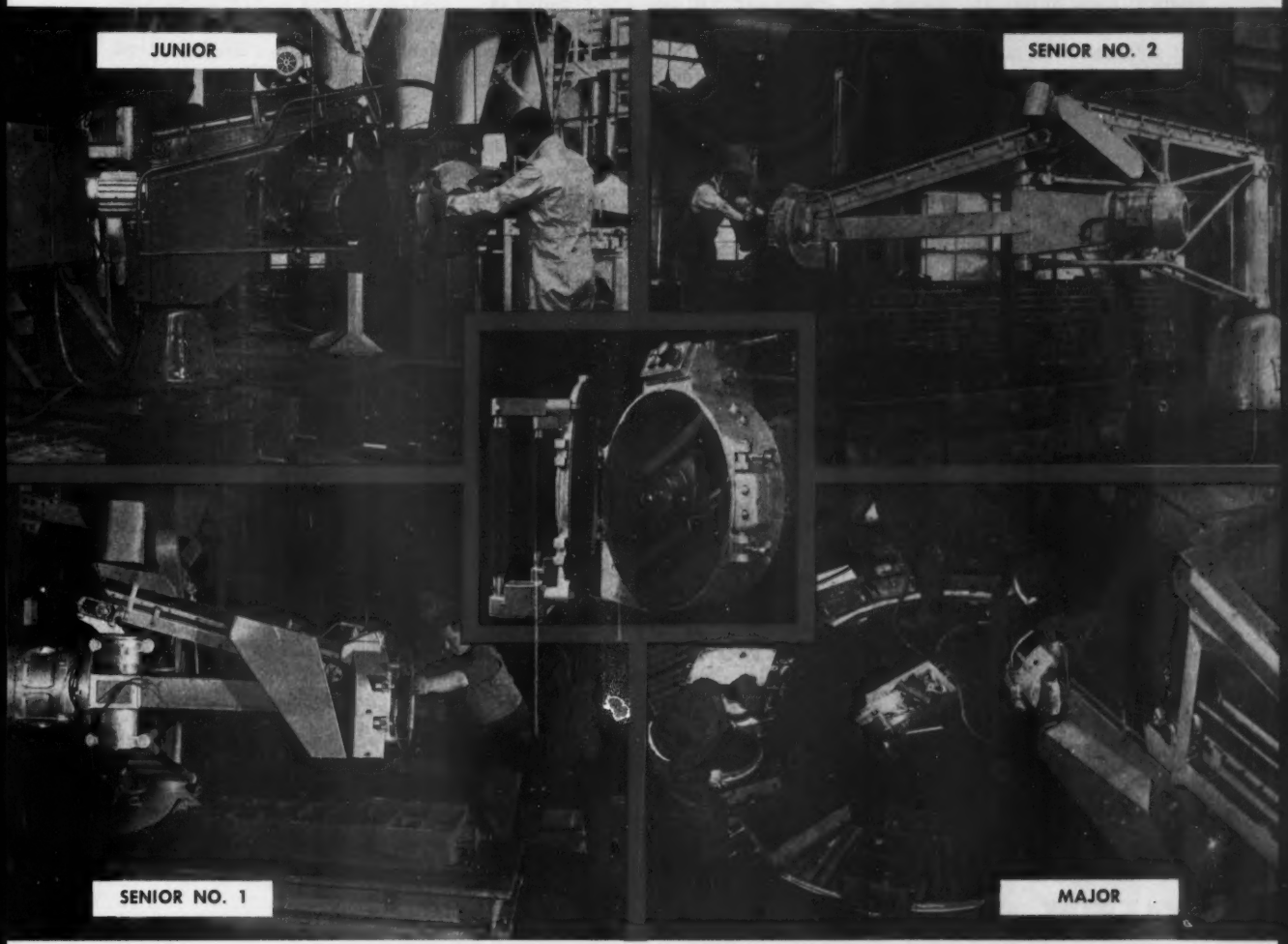
Visible liquid level gage is for reading inventory and controlling batching amounts. Gages are available on reinforced plastic tanks. Any liquid level can be seen clearly through the translucent tank walls and read on a calibrated gage running the height of the tank. Tank is available in standard sizes and suited for any liquid.—**Jones & Hunt Inc.**, Adelaide Road, Gloucester, Mass.

For More Details Circle No. 466—Page 53

ELECTRIC HOISTS

Two-speed models have been added to Series 600 Load Lifter electric hoists. Two-speed hoists provide slow speed to permit close spotting plus high speed for rapid movement of load before and after spot-

USED ALL OVER THE WORLD



F. E. SANDRAMMERS

Here's *F. E.* equipment that has increased production and decreased costs in hundreds of foundries throughout the world, including a considerable number in the U. S. A. Shown above are four of the many models of *F. E.* Sandrammers, for a wide variety of mold and core jobs in both production and jobbing foundries. They can be used with natural or synthetic molding sands and most core sands — wood or metal patterns, loose or mounted, and core boxes can be used with a minimum of wear.

F. E.'s exclusive "multi-bladed impellor" ensures continuous, hard-ram, sand projection without vibration, making for easier handling and less wear on the machine. "Power-assistance" means more production, with less operator fatigue. Prompt delivery. Low installation cost. Free "start-up". Full replacement parts service.

For complete information on all models, write for Bulletin 150/NA.

F. E. NORTH AMERICA, LTD.

47 ADVANCE ROAD, TORONTO 18, ONTARIO, CANADA

TELEPHONE: BELMONT 3-3227 • **TELEGRAMS:** EQUIPMENT, TORONTO

MOLDING MACHINES • SANDRAMMERS • SHELL MOLD AND CORE MACHINES • COMPLETE SAND HANDLING SYSTEMS

Circle 609 on Page 53

ting. High-torque, squirrel-cage type motor is used. Models are offered in ½ and 1-ton capacities, all standard voltages, with choice of several lifting speeds and various suspensions.

Construction features include main suspension frame and end covers of lightweight aluminum alloy castings, gray iron lifting drum with machine-cut grooves and large diameter for long cable life, friction-resistant bearings, two separate brakes (each capable of holding capacity load), safety upper limit stop to prevent upward overtravel of lower block, and 24 v at push buttons to eliminate danger of severe shocks.—**Manning, Maxwell & Moore Inc., Shaw-Box Crane & Hoist Div.,** Muskegon, Mich.

For More Details Circle No. 467—Page 53

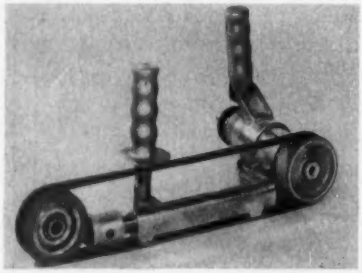
LIQUID PARTING

Kenslip "A" is a solvent-based liquid parting which provides a thin transparent coating. Material is water repellent and reduces wear and abrasion of patterns, plates, and boxes. It does not react on ferrous and nonferrous patterns and coreboxes and will not attack paints or other coatings. Kenslip also is available in water-base emulsion form. —**Para Products Div., Foundry Rubber Inc.,** 5200 River Rd., Washington 16, D. C.

For More Details Circle No. 468—Page 53

PORTABLE BELT SANDER

Portable abrasive belt unit for operations requiring slack of belt,



contact wheel, or platen is air-powered. Unit can be hand-held or bench-mounted and is designed for heavy stock removal as well as for polishing and blending. Belt change is quick, and tracking is easy. Air motor develops about 1 hp at 6000 rpm. Belt speed is 4500 sfpm. Unit uses a 1 x 36-in. abrasive belt.—**Nu-Matic Grinders Inc.,** 8224 Carnegie Ave., Cleveland 3, Ohio.

For More Details Circle No. 469—Page 53

CORRUGATED STEEL BOX

All-corrugated steel box, 33 x 48 x 24 in. deep, features welded construction with square corners and stacking pockets which permit boxes to be tiered. Boxes have four-way entrance for moving by fork truck, with fork slots for rotary dumping. —**Palmer-Shile Co.,** 16033 Fullerton, Detroit 27, Mich.

For More Details Circle No. 470—Page 53

HYDROGEN ANALYZER

Hydrogen analyzer is used to check incoming material, control processing, determine causes of failure, and correlate the effects of hydrogen content with physical properties. Using the hot extraction principle, the unit meets ASTM requirements of 1200° C or 2192° F operating temperature. Outgassing of

EXECUTIVE REPORT #1

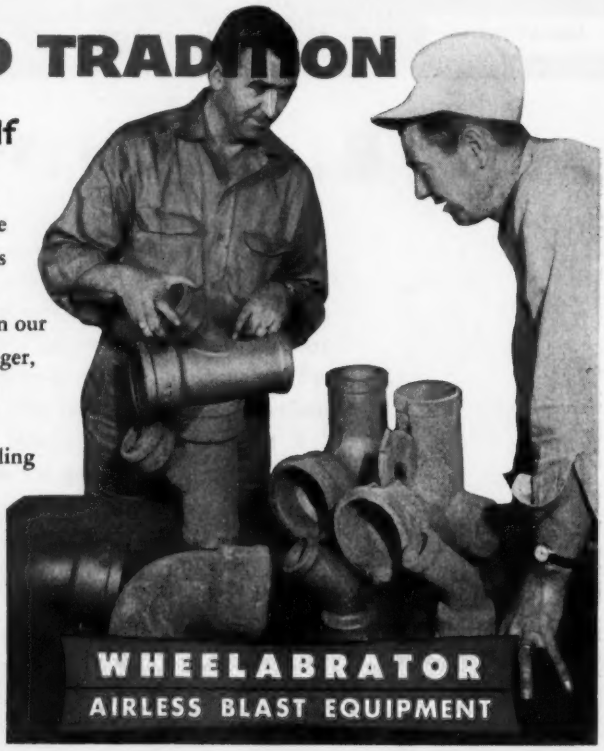
THEY SCRAPPED TRADITION

...to cut cleaning costs in half

Everyone from top management to the cleaning room foreman at Wahkonsa Foundry Co. endorses the change from barrel type tumbling mills to Wheelabrator airless blast cleaning of their gray iron and semi-steel castings. "We seldom get enthused or excited over any change in our production methods", says F. W. Dennis, foundry manager, "but the Super Tumblast has proven to be the ultimate in cleaning methods for our needs." His judgment in selecting the Wheelabrator has been confirmed by doubling their production rate, improving the cleaning quality, and cutting labor and operating costs squarely in half.

See how Wheelabrator Engineering can Improve Your Blast Cleaning Operation

The chances are you, too could benefit by modernizing your blast cleaning with Wheelabrator equipment and engineering. Call your nearest Wheelabrator office or write to Wheelabrator Corp., 505 S. Byrkit St., Mishawaka, Ind. In Canada, P. O. Box 490, Scarborough, Ont.

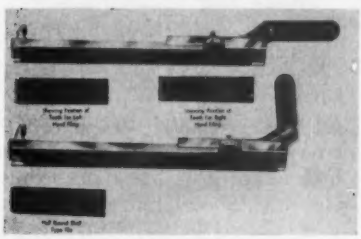


a crucible is eliminated by use of an inert, blank free susceptor. Another device allows one sample to be loaded at a time and removed from the system, after extraction, simply and quickly without breaking the vacuum. Extraction time is 3 to 10 min, depending on the material analyzed.—**Laboratory Equipment Corp.**, P. O. Box 151, St. Joseph, Mich.

For More Details Circle No. 471—Page 53

FILES

Kwick Kleen files can be used on all metals, wood, and plastics. By



oscillating the wrench which comes with the file, an accumulation of particles in the teeth of the file can be removed. Direction of the cut of mill type files can be reversed from conventional angles to the opposite angles for left-handed workers. Files are made in four teeth sizes.—**Gordon Associates Inc.**, First Street, Derby, Conn.

For More Details Circle No. 472—Page 53

SEQUENCE TIMING BOARD

Multi-Sequence board actuates three stopwatches at precisely the same instant with a simple squeeze of the hand which carries the board. Based on a design devised and widely used by professional time-and-motion experts to collect "standard data," the apparatus has applications in laboratory research, field action-studies, process control, materials handling, production timing, traffic analyses, and much other work.

The unit times sequential steps with zero time loss between those steps and with no necessity to read timer hands while they are in motion. Board is of 3/16-in. thick, chipless black plexiglas, shaped for maximum arm comfort. The three

stopwatches are held between individual spring-loaded cradles and a common alignment plate around the stems.—**Heuer Timer Corp.**, 441 Lexington Ave., New York 17, N. Y.

For More Details Circle No. 473—Page 53

TESTING MACHINES

Hydraulic "push-pull" universal testing machine can apply tension and compression loads to the same specimen alternately. Any tension load within machine capacity can be applied for push-pull testing. The operator then can reverse the load immediately and go back through zero into a compression test of the

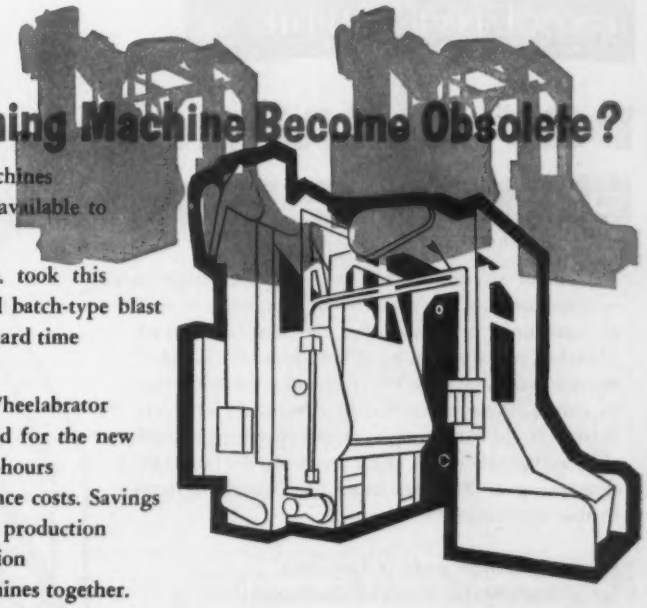
EXECUTIVE REPORT #2

When Does a Blast Cleaning Machine Become Obsolete?

A good production tool including blast cleaning machines becomes obsolete whenever a better tool becomes available to do its job at lower cost.

The management of Canton Malleable Iron Co. took this progressive viewpoint in evaluating their two old batch-type blast machines — both still working well, but having a hard time keeping up with increased cleaning demands.

They replaced both machines with one 14 cu. ft. Wheelabrator Super Tumblast. The savings made more than paid for the new equipment in less than two years. Savings of 16 man-hours daily in direct labor. Savings in reduced maintenance costs. Savings in record low abrasive consumption. And savings in production time, since the Super Tumblast handles all production cleaning many times faster than the two older machines together.



Wheelabrator takes the Guess-Work Out of heavy-duty blast cleaning

With approximately 200 Super Tumblasts in operation, only Wheelabrator has the necessary experience in solving these heavy-duty blast cleaning problems. Write for Bulletin 145-D giving documented performance results.

Wheelabrator Corp., 505 S. Byrkit St., Mishawaka, Ind.
Canadian Division: P.O. Box 490, Scarborough, Ont.

WHEELABRATOR
AIRLESS BLAST EQUIPMENT

same specimen. This process can be repeated as desired. Rapid crosshead positioning is accomplished with a conventional electric motor drive built into the crosshead. Hydraulic clamps automatically lock the crosshead adjusting nuts to the screws and reduce backlash during load reversal-type tests.—**Tinius Olsen Testing Machine Co.**, 139 Easton Rd., Willow Grove, Pa.

For More Details Circle No. 474—Page 53

SURFACE PLATES

Reversible black granite surface plates feature removable trunnions to facilitate turning the plates. Trunnions are standard bolts screwed into two threaded inserts permanently imbedded in the granite. Inserts are set flush into the center of the short sides and present no obstruction. Plates are available in sizes from 8 x 12 in. to 48 x 144 in. Use of a double-faced plate saves downtime since the plate needs less reconditioning. Clamping is easy because the stand provides an overhang to permit clamping at any point.—**DoAll Co.**, 254 N. Laurel Ave., Des Plaines, Ill.

For More Details Circle No. 475—Page 53

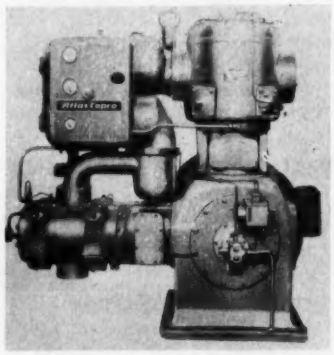
TEMPERATURE CONTROLLER

Temperature controller is an economical, small, rugged instrument which is quick to sense temperature change and maintain close control of process equipment from 0 to 1100° F. The control circuit is through an SPDT snap switch rated at 15 amp, 120 v, 60 cycles. Unit is suitable for direct operation of noninductive, electrically heated processes or operating electric switchgear for diversified electric loads. Controller has a liquid-filled bellows type thermal system with remote bulb. Bulb is ¼-in. diam.—**R. A. Ekstrom Co.**, P. O. Box 206, Harvey, Ill.

For More Details Circle No. 476—Page 53

AIR COMPRESSORS

High-pressure air compressors have output up to 498 cfm at 225 psi. Basic crosshead design of AR-type compressors suits the units to high compression operation because crosshead shoes, rather than pistons, absorb large lateral stresses. Machines are two-stage, water-cooled. Air delivery is within a relatively low temperature range, assur-



EXECUTIVE REPORT #3

DRY CLEANING ELECTRIC FURNACE FUME

Control of air pollution is management's concern — your concern. It's a matter of economics as well as community and employee relations. And cloth filtration, as employed by Wheelabrator® Dustube® equipment, is the most effective and economical way to eliminate air pollution. In control of electric furnace fume, for example, more experience is available at Wheelabrator than anywhere else. Efficiencies up to 99% are usual for Dustube systems in this application.

No air pollution code is too strict for Wheelabrator Dustube Collectors

Bulletin No. 562-D illustrates how industry relies on Dustube Collectors for efficient dust and fume control. Write to Wheelabrator Corp., 505 S. Byrkit St., Mishawaka, Ind. In Canada, P. O. Box 490, Scarborough, Ontario.

ing long service life for valves.—**Atlas Copco Eastern Inc.**, 610 Industrial Ave., Paramus, N. J.

For More Details Circle No. 477—Page 53

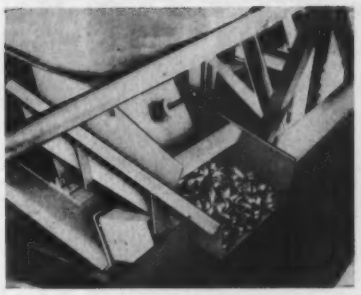
ANCHOR BOLT AND WELL

Flexible and retractable anchor bolt and well is engineered to anchor large presses and other heavy machinery safely and easily. No projection shows above the floor surface to cause interference when equipment is moved into place. Anchor bolt is dropped to the bottom of the well. After the equipment is in position, the anchor bolt is moved under the bolt hole and pulled up through the hole. The rectangular shape of the well and bottom plate prevents the anchor bolt from turning.—**Paton-Reynolds Co.**, 2150 N. Ritter Ave., Indianapolis 18, Ind.

For More Details Circle No. 478—Page 53

VIBRATORY FEEDERS

Feeders will perform efficient, controlled feeding of parts by use of an electromagnet drive which produces 3600 smooth vibrations a minute. Vibrations are controlled by a rheostat which is easily operated. Feeder is particularly useful in plants manufacturing automatically or semiautomatically fabricated metal products, but will feed other parts effectively. — **Syntron Co.**, 540 Lexington Ave., Homer City, Pa.



For More Details Circle No. 479—Page 53

BALANCED WAVE WELDER

Model BWC-300MAP balanced wave TIG welder is said to offer perfect balance even during crater elimination and arc stability without high frequency down to 18 amps. The dc component is removed to eliminate arc-outs during weld cycle. Unit is controlled with safe, low-voltage regulation from panel or remote station. Voltage reducer automatically lowers the open circuit voltage when arc is struck or broken. Five separate welding ranges insure proper current for any job.—**Miller Electric Mfg. Co. Inc.**, 718 S. Bounds, Appleton, Wis.

For More Details Circle No. 480—Page 53

THERMOCOUPLE HEAD

Small-size Mini-Head thermocouple connection-head is said to be rugged and weatherproof. Designed for use in high-ambient temperatures and corrosive atmospheres, it features an all-stainless steel chain and nonremovable screws to avoid dropping or mislaying the screw cover.

Connection-head contains a high-temperature refractory terminal block which fits No. 7 gage or smaller TC wires and No. 12 or smaller extension wires. Special adapters hold 4 sizes of metal-

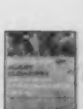
EXECUTIVE REPORT #16

HOW MANY TRIANGLES* CAN YOU FIND IN THIS STAR?

Look for the hidden value in blast cleaning abrasives, too

The "hidden values" you get in a high quality steel abrasive, like Wheelabrator Steel Shot, far outweigh any price advantage of the so-called "economy" abrasives. Wheelabrator Steel Shot is harder and tougher — lives for many more cycles through your blast equipment. It cleans better — allows shorter blast cycles. You'll get better, faster cleaning, lower maintenance, lower actual cleaning costs with top quality Wheelabrator Steel Shot. Thousands of users do. Your Wheelabrator Abrasive Engineer will prove it.

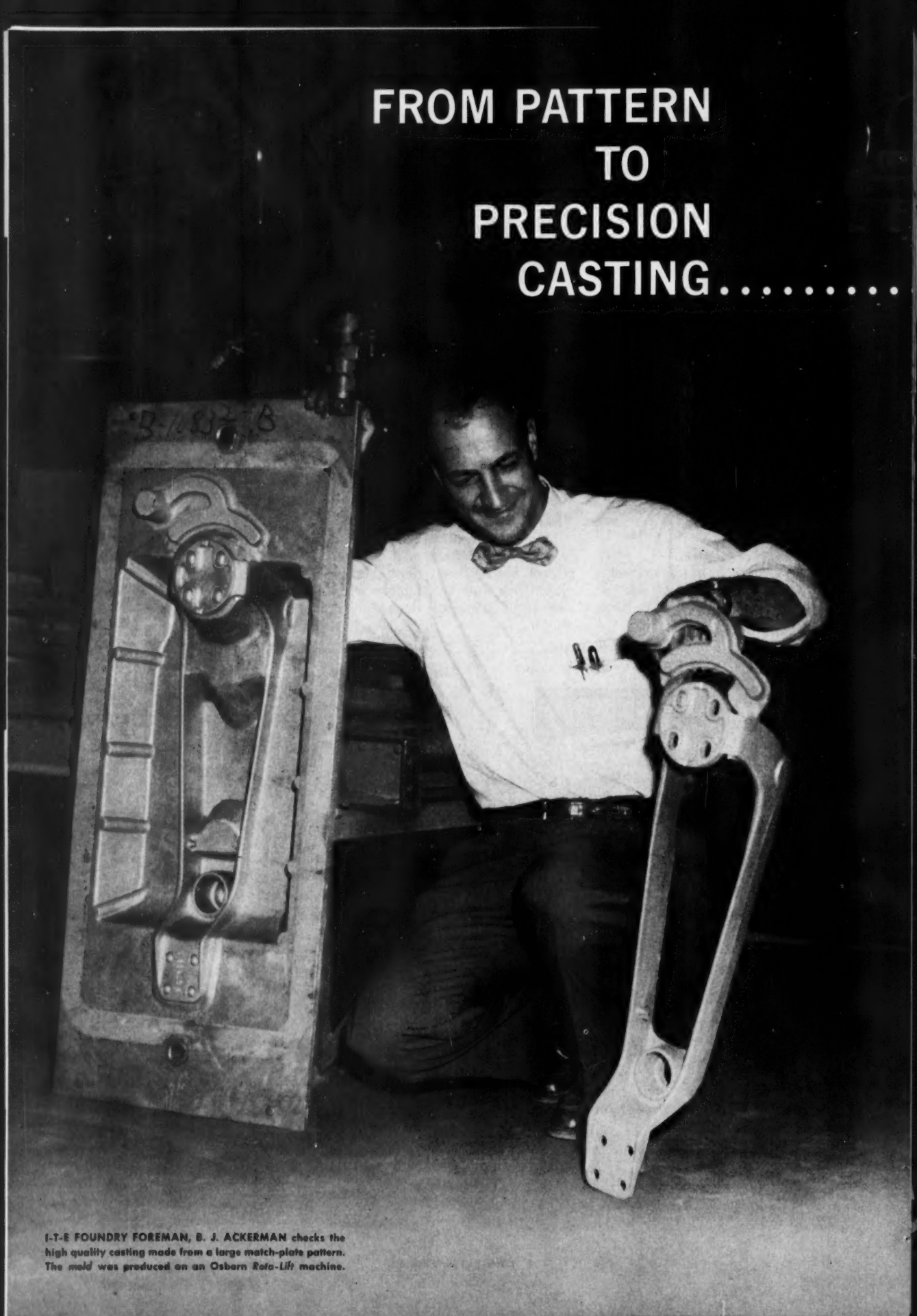
Write today for this new handbook of blast cleaning abrasive performance, full of charts and facts to help you control abrasive consumption and reduce cleaning costs. Write to **Wheelabrator Corp., 505 S. Byrkit St., Mishawaka, Ind. In Canada, Wheelabrator Corp., Canadian Div., P.O. Box 490, Scarborough, Ontario.**



WHEELABRATOR
AIRLESS BLAST EQUIPMENT

If you examine it closely enough, you'll find 97 triangles.

FROM PATTERN TO PRECISION CASTING.....



I-T-E FOUNDRY FOREMAN, B. J. ACKERMAN checks the high quality casting made from a large match-plate pattern. The *mold* was produced on an Osborn *Rota-Lift* machine.

"PERFECT MATCH"

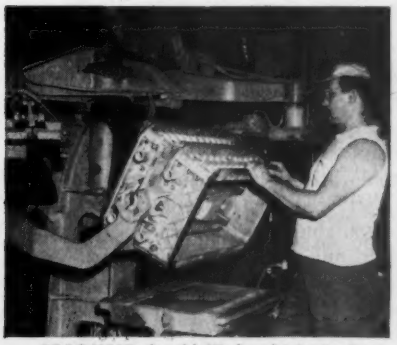
. . . and OSBORN Rota-Lift® with new match-plate handler does the molding job with more speed . . . more profit

They're proving it at I-T-E Circuit Breaker Co. where this Osborn *Rota-Lift* Molding Machine has been running a wide variety of work for over a year. The score: production and quality *up* . . . costs and operator fatigue *down* because *Rota-Lift* mechanizes all major match-plate molding operations: jolt, roll, squeeze, draw and close.

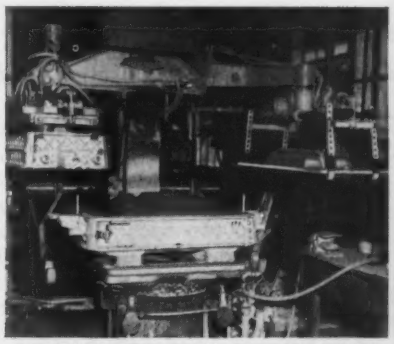
I-T-E—here at its Greensburg, Pennsylvania foundry—has been producing relatively large match-plate molds, similar to the 15″x32″—6″ drag, 7″ cope mold shown in the photo sequence below. And they found the new *Osborn match-plate handler* especially efficient on jobs involving extra-heavy pattern plates.

For any jobbing or semi-production foundry—Osborn will recommend the right model *Rota-Lift* to improve your molding operation . . . help keep your quotes competitive . . . let you handle a wider range of work . . . at a profit. Write for details. *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

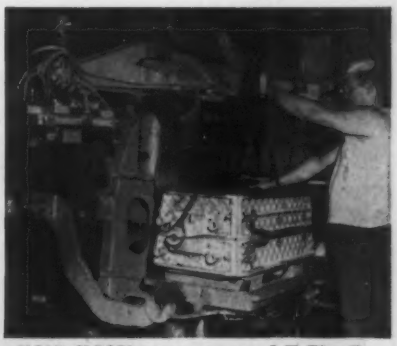
HOW ROTA-LIFT® MOLDING MACHINE MECHANIZES OPERATIONS AT I-T-E



DRAG HALF of mold filled and jolted . . . bottom board secured. Operator easily rolls over the mold on *Rota-Lift* rollover arms prior to filling cope and squeezing.



ROTA-LIFT MATCH-PLATE HANDLING DEVICE—shown swung out at right—has drawn pattern from drag. Cope mold is swung out at left . . . drag half of mold rests on *Rota-Lift* table. Operator now ready to return cope and close mold.



MOLD CLOSED—operator uses I-T-E's efficient chain sling setup with overhead crane and monorail system to transfer mold to pouring conveyor. Flasks are opened and removed to complete the operation.

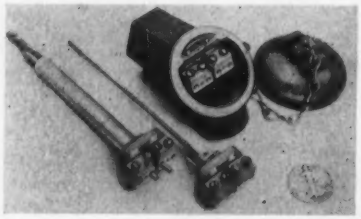
MEMBER FEMA

THE OSBORN MANUFACTURING COMPANY
5401 Hamilton Avenue, Cleveland 14, Ohio

OSBORN®

MOLDING MACHINES • CORE BLOWERS • METAL FINISHING MACHINES • INDUSTRIAL BRUSHES

Circle 614 on Page 53



sheathed thermocouples. Unit has a red silicone-paint coating. Terminal blocks are marked plus or minus. Pressuretight to 125 psi, the connection-head is available with a ¾-in. conduit outlet and choice of 5 protecting-tube outlet sizes.—**E. C. Smith Mfg. Co. Inc.**, Forrest and Hector Streets, Conshohocken, Pa.

For More Details Circle No. 481—Page 53

DUST CONTROL SYSTEM

Portable dust control system is for single point dust suppression or controlled wetting of raw materials. Unit is called Chem-Jet and is available in four models. Each includes a proportioner, mixing chamber, and auxiliary controls mounted on a portable hand truck. Hand truck can be removed and the installation made a permanent, fixed unit. Standard unit is set to deliver 6 gpm of solution when attached to a plant water supply at 40 psi. Electricity is the only other connection required.

Other equipment includes pressure differential switch, 25 ft of electrical extension cord, 25 ft of ¾-in. hose, and a hand grip nozzle assembly. The motor is 1/6-hp, 110-v, 60-cycle, single-phase unit.—**Johnson-March Corp.**, 1724 Chestnut St., Philadelphia 3, Pa.

For More Details Circle No. 482—Page 53

SINGLE-STAGE COMPRESSOR

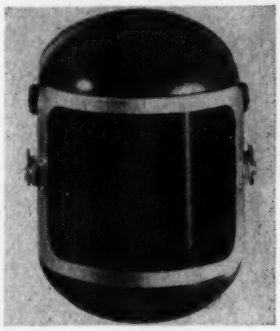
A vertical, single-stage compressor, WG-9H, has been added to the company's line of heavy duty air compressors. Machine has piston displacements from 633 to 1630 cfm

with maximum pressures to 125 psi and hp ratings to 150. Single-stage compressor models include 20 sizes including 5, 7, and 9-in. piston strokes.—**Joy Mfg. Co.**, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

For More Details Circle No. 483—Page 53

WELDING HELMET FILTER

Plastic-Weld filters remove harmful ultra-violet and infrared rays of arc welding and filter them to the same degree as federal specifications for glass. Filters last longer because of less breakage. The lightweight filters are available in standard 2 x



4½-in. size and 7 x 11-in. panoramic window version. — **Chicago Eye Shield Co.**, 2727 W. Roscoe St., Chicago 18, Ill.

For More Details Circle No. 484—Page 53

ABRASIVE BELT HEAD

Abrasive belt head is for grinding and polishing convex or concave surfaces of aluminum, brass, and steel castings. Positive belt control at heavy work pressure is provided by an air-operated scanning eye which prevents belt runoff. Machine's rigid construction and formed contact wheel permit close tolerance and true shape on finished products. Tension takeup is air-controlled as the abrasive belt oscillates. Contact roll is supported by a sturdy outboard bearing arm. An ammeter is provided to show work effort. A continuous chain reciprocates the platen-mounted fixture.—**Murray-Way Corp.**, P. O. Box 180, Birmingham, Mich.

For More Details Circle No. 485—Page 53

SAFETY GOGGLE FRAMES

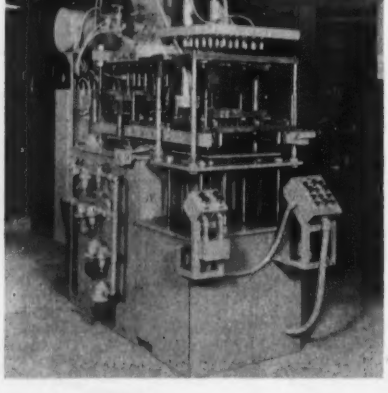
Rapido line of custom-fitting safety goggle frames feature Retrax temples which telescope for comfortable fit and a spread-end frame for fast lens replacement. Frames are available with or without side shields and with plastic or hardened safety glass, clear or green S7 lenses.—**Watchemoket Optical Co. Inc.**, 232 W. Exchange St., Providence 3, R. I.

For More Details Circle No. 486—Page 53

FLOW INDICATOR

Ball-type flow indicator is for flows down to 0.075 gpm (water) and ½ cfm (air or gas). Unit is

Automatic Unit Makes Shell Cores and Molds



Gas-fired Blo-Core automatic shell machine is a two-station rotary shell blower said to be capable of producing shell cores and shell molds simultaneously. Available in two sizes, the Blo-Core produces up to 100 blows per hour.

The unit can produce horizontally parted boxes up to size 24 x 32 x 16-in. draw and vertically split boxes up to size 24 x 15 x 24 in. high. — **C & S Products Co.**, 18656 Fitzpatrick Ave., Chicago 14, Ill.

For More Details Circle No. 495—Page 53

Faster inspection... better results electronically with

PENOLA 75 CORE BINDER

Foundrymen have found that the oscillograph can aid them greatly when inspecting castings. They also have found that when baking cores electronically with a dielectric core oven, they can bake cores in minutes instead of hours. These men also know the advantages of using an economical *core oil type* binder in dielectric baking and they specify Penola 75 Core Binder . . . to get longer binder storage life, oil sand core properties and workability for all metals, better odor, and a cleaner bake with optimum collapsibility.

As a leading producer and nation-wide marketer of core oils for 30 years, Penola is proud of its position as a leader in the development of new and more efficient core oils. For further information, contact *your* nearest Penola office or write: Penola Oil Company, 15 West 51st Street, New York 19, N. Y.

Penola

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for applications such as flow of cooling water to compressors and lubricating oil to bearings. Indicator is made in ½-in. pipe size for pressures up to 100 psi with die-cast bronze body and either Nylon or Teflon ball.—**McIntosh Equipment Corp., Walker, Crosweller Div.**, 15 Park Row, New York 38, N. Y.

For More Details Circle No. 487—Page 53

LIFTING MAGNETS

Lightweight, heavy-duty scrap metal lifting magnets are called

Pow-R-Light series and are available in five diameters—36, 39, 45, 55, and 66 in. Magnets feature aluminum field coils and rugged, all-welded construction. Use of aluminum eliminates bulky insulation-saving weight and reduces the possibility of burnout. Other features include watertight construction, replaceable pole shoes, recessed and protected terminal box, and exceptionally low silhouette. — **Stearns Magnetic Products**, 635 S. 28th St., Milwaukee 46, Wis.

For More Details Circle No. 488—Page 53

BOND STRENGTH TESTER

By combining a dynamometer with a screw jack and other shop

materials, an efficient tensile tester can be fabricated easily and inexpensively. The instrument can be used to measure strength of resinous or sheet materials or to test holding power of glues, mortars, or mechanical fasteners.

Dynamometer integrated with a screw jack is placed over a hook with a plug anchored within or under the material to be tested. Hook and dynamometer clevis are joined, and the jack is turned slowly until the material gives way. At that moment, the dynamometer gives the tensile strength in pounds. Units are available in 13 capacities from 500 to 100,000 lb, with either 5 or 10-in. dials.—**W. C. Dillon & Co. Inc.**, 14620 Keswick St., Van Nuys, Calif.

For More Details Circle No. 489—Page 53

SAFETY HATS AND CAPS

Safety hats and caps are available in fiberglass, aluminum, or plastic (electrical). Outstanding feature of the hats is a contour-fit suspension allowing the hats to conform comfortably to the head without a top-heavy feeling. A numbered snap-in adjustment provides quick, easy adjustment of head size from 6⅝ to 8. Plastic-zippered sweat band can be taken out and replaced without affecting suspension. Offered in several colors, the hats and caps are lightweight and durable.—**Bausch & Lomb Optical Co.**, Safety Products Dept., 635 St. Paul St., Rochester 2, N. Y.

For More Details Circle No. 490—Page 53

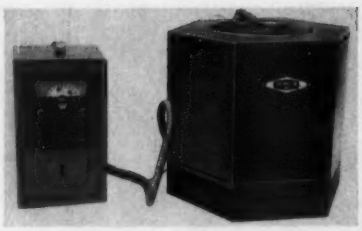
AIR CYLINDERS

Model "A" air cylinders in 1½ to 14-in. bores are rated for operation up to 750 psi, depending on bore size. Standard equipment includes seals of the pressure-sealing type, static seals of Teflon, case-hardened hard chrome plated piston rods, rust-resistant surfaces, and solid steel heads, caps, and mountings.—**Miller Fluid Power Div., Flick Reedy Corp.**, York and Thorndale Roads, Bensenville, Ill.

For More Details Circle No. 491—Page 53

ELECTRIC FURNACES

Type 2100 top-loading electric furnaces are multipurpose units for use as salt bath, melting, vertical muffle, or crucible furnaces. Maximum chamber temperature for intermittent operation is 1900° F. Basic unit includes a hexagonal furnace (115 or 230 v, chamber 6⅝



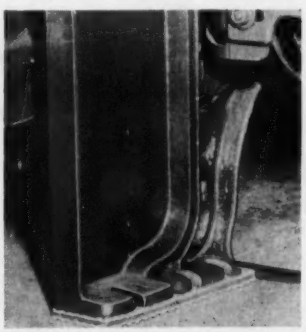
in. diam x 11½ in. deep), stainless steel pot (6½ in. diam x 7½ in. deep) with cover and convenient lifting handle, and thermocouple in protection tube.

Furnace case is of heavy-gage welded and braced steel construction and is finished in corrosion and heat-resistant enamel. Heat loss is minimized and even temperatures maintained by use of three types of insulation. Several types of controls are offered, both manual and fully automatic.—**Thermo Electric Mfg. Co.**, 622 Huff St., Dubuque, Iowa.

For More Details Circle No. 492—Page 53

VIBRATION CONTROL PAD

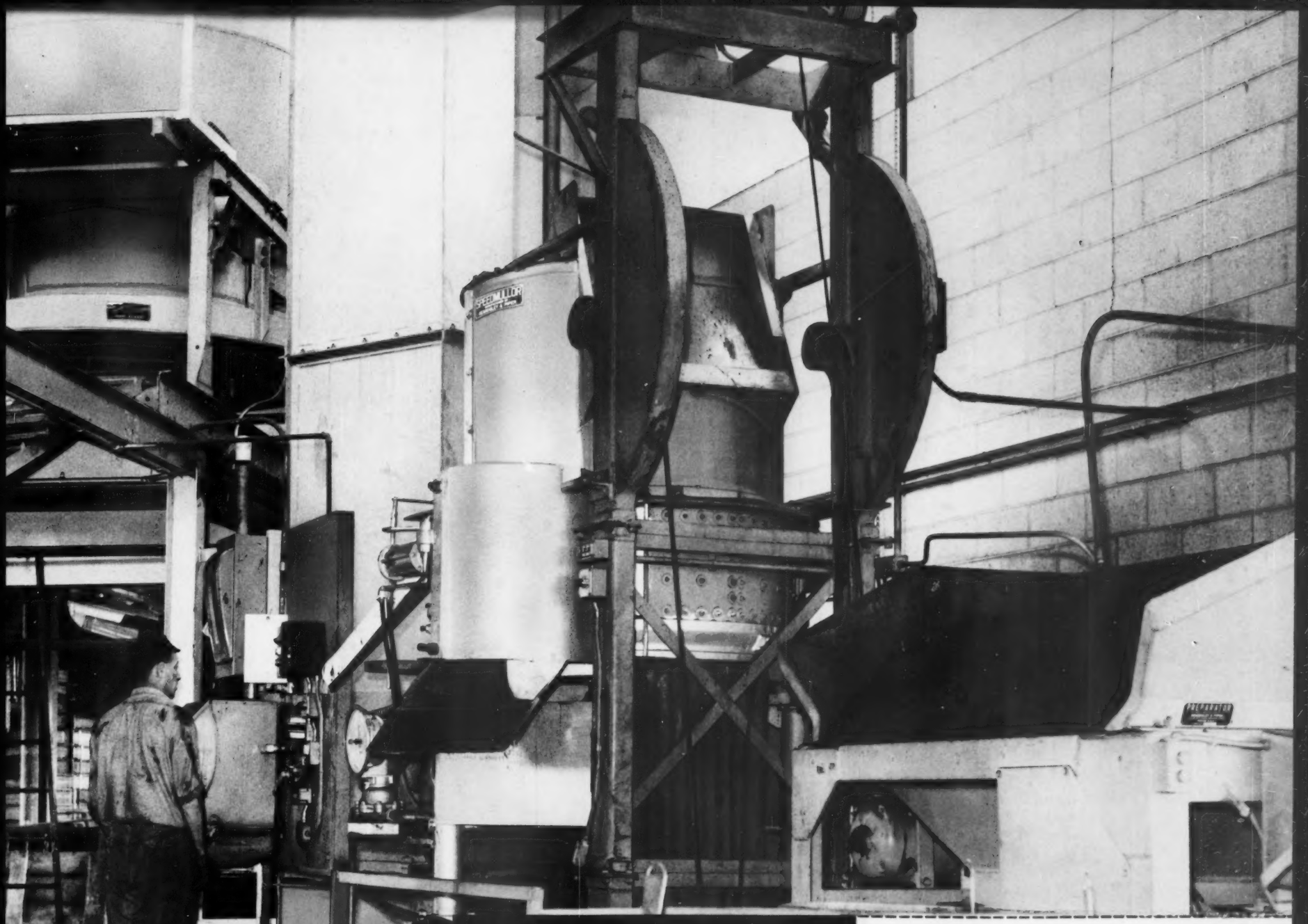
Vibra-Check is a synthetic material composed of two layers of tough vinyl chloride elastomeric resin, bonded to both sides of a strong reinforcing core of monofilament fiberglass. Material is designed to be placed under machines to prevent transmission of vibration and

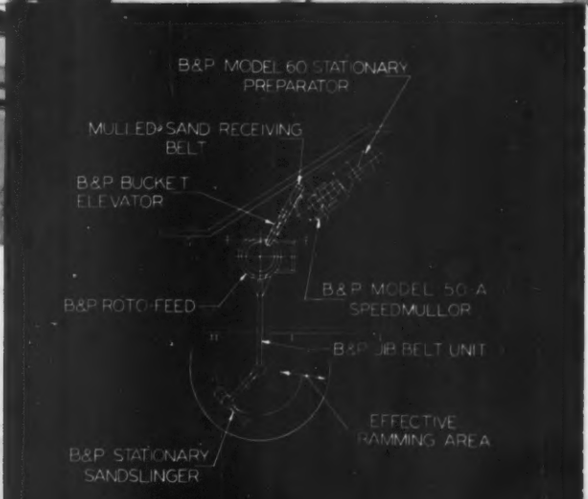


noise. Lagging or cementing of the material to the floor is eliminated because of the material's vacuum suction cup pattern. Vibra-Check conforms to rough or uneven floors. It is available in sheets 22 x 23 in. or can be furnished cut to sizes suitable for any machine to yield a unit loading of between 50 to 100 psi, the area of greatest vibration-absorptive efficiency. — **Lowell Industries Inc.**, Allston Station, Boston 34, Mass.

For More Details Circle No. 493—Page 53

Circle 616 on Page 53→





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BUILT-IN SKILL

Small Nekoosa Foundry* had a *serious problem.* A chronic skill shortage aggravated production problems . . . made quality control difficult. Costs were high, and getting higher. But there was a *solution!*

Nekoosa installed a Speedmullor-Preparator Unit

because fast, thorough Speedmullor-Preparator Units provide precise control of all mulling variables without highly skilled operators.

because rugged Speedmullor-Preparator Units provide more years of low maintenance operation.

because economical Speedmullor-Preparator Units provide the most productive capacity at the lowest operating cost.

because more sand is prepared in Speedmullor-Preparator Units than all other units combined.

They installed a Sandslinger

because Sandslingers have "built-in skill" to handle the widest variety of jobs.

because Sandslingers offer maximum flexibility.

because Sandslingers cost less to install . . . less to maintain . . . use existing patterns and flasks.

because Sandslingers are efficient . . . no penalty for capacity.

And here are the results:

A serious skill shortage solved.

Molding time cut by as much as 60%.

Casting quality improved.

Competitive position improved.

*Nekoosa Foundry and Machine Works, Inc.
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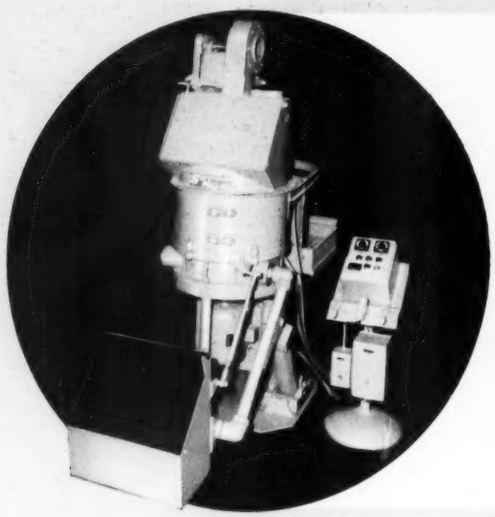


Low Cost Shell Sand Unit!

Budget-minded foundries cut shell sand costs in large or small shell-process departments with the Shell Mull-All. There is plenty of capacity to keep several high-speed shell core making units in full, profitable operation.

This low-cost unit provides up to 4,500 lbs. of shell sand per hour with the preheat process . . . up to 3,000 lbs. per hour using the cold process.

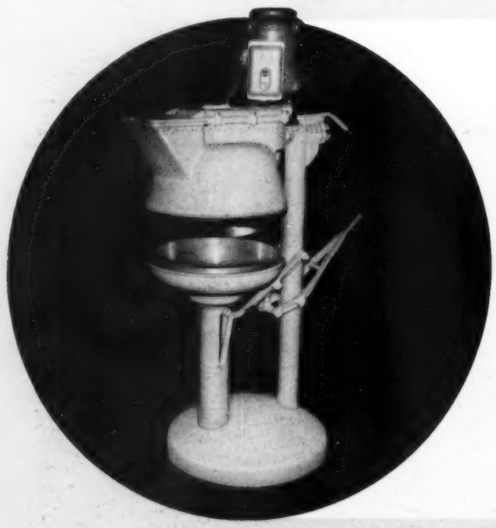
The Shell Mull-All is a complete ready-to-operate package with skip-bucket loading device, cooling and conveying screen and Mulltrol automatic control unit.

Other low-cost Mull-All models are available for molding, facing and core sand application, too.

Increase Core Production with Available Skill!

Anyone can draw complex cores with the Vibra-Draw. Team it with the Flexiblo and you can produce hard-to-make jobbing cores on a real production basis with relatively *unskilled manpower.*

Machined grooves in the draw head and an air vibrator make every draw accurate regardless of core box draft or height of draw. The ruggedly built Vibra-Draw will provide years of trouble-free service.



New Low Cost Lab Unit Improves Sand Control

New plow design, scientifically contoured mulling bowl, and rubber-tired mulling wheels assure thoroughly mulled sand batches which very closely duplicate molding and core sand mixtures prepared by production Speedmullors. The Lab Mulbaro provides close laboratory control of sand preparation and permits practical, low cost experimentation with the many new binders. Mulltrol is available for batch after batch uniformity through precise control of the mulling cycle. Lab Mulbaros quickly pay for themselves through improved sand control, improved sand properties and the ensuing improvement in casting quality.

◀ USE THIS CARD TO LEARN ABOUT YOUR STAKE IN B & P RESEARCH

SFSA officers, directors and staff. Seated, left to right: R. M. Schumo, executive committee member; W. H. Moriarty, president; F. B. Powers, vice president; R. G. Parks, treasurer; F. K. Donaldson, executive vice president. Standing: J. R. Patterson, director; W. F. Dudley, director; F. G. Frink, Jr., director; J. A. Ross, director; J. F. Eberle, director; C. W. Briggs, technical and research director; Erwin Dieckmann, assistant secretary; G. K. Dreher, market development director

STEEL FOUNDERS' SOCIETY

Plans for the New Decade

By WILLIAM G. GUDE
Managing Editor

● APPOINTMENT of a new committee to appraise the activities of the Steel Founders' Society of America and chart the society's course for the 60s was announced at the SFSA annual meeting in Chicago, March 7-8.

Retiring president Ross L. Gilmore, president, Superior Steel & Malleable Castings Co., Benton Harbor, Mich., said that the committee, made up of nine presidents and vice presidents of SFSA member companies, will evaluate present activities and recommend long-range society action to meet the problems of the steel foundry industry in the coming decade.

Chosen to serve on this Program Evaluation Committee are C. E. Grigsby, American Steel Foundries, chairman; A. M. Andorn, Penn Steel Castings Co.; James A. S. Thompson Jr., Symington-Gould Co.; J. M. Kincaid Jr., K. O. Steel Casting Inc.; T. F. Dorsey, Pittsburgh Steel Foundry Corp.; I. M. Emery, Massillon Steel Casting Co.; A. M. Slichter, Pelton Steel Casting Co.; W. A. Miller, Keokuk Steel Casting Co.; E. F. Marquardsen, Pacific Steel Casting Co.

W. H. Moriarty, first vice president and group executive, National Malleable & Steel Castings Co., Cleveland, succeeds Mr. Gilmore as president of the society. He was elected by the board of directors earlier in the year and took office at the conclusion of the annual meeting.

Clyde B. Jenni, left, chief metallurgist, General Steel Castings Corp., receives the society's Technical and Operating Medal from Ross L. Gilmore, retiring president, in recognition of service to the industry

Discussion panel included, left to right, past presidents T. H. Shartle, H. A. Forsberg, A. M. Andorn, and president-elect W. H. Moriarty

Mr. Gilmore, in his report to the 200 executives in attendance, reviewed the work of the society during his two terms as president, saying that he felt much had been accomplished in market development, research, and management accounting efforts.

He announced that the society's design contest will be revived during the coming year; no contest was held in 1959. Mr. Gilmore also reported that the new *Steel Castings Handbook* will be published this fall. Now in course of preparation, the handbook will replace a 1950 edition. Instead of merely a revision, the book is being completely rewritten.

F. Kermit Donaldson, executive vice president of SFSA, briefly reviewed society activities and warned his audience of the growing seriousness of foreign competition in the steel casting industry. He also commented on the necessity of trade associations to provide the information needed for management decisions.

Other reports during the business sessions were given by SFSA treasurer R. G. Parks, treasurer of National Malleable & Steel Castings Co., Cleveland; SFSA legal counsel Chauncey Belknap; and SFSA Washington representative A. J. McDonald.

Mr. McDonald reviewed some of the proposed legislation pending before Congress, and explained regulations governing defense materials. He indicated that planned revisions in specifications for bridges in the federal highway program could result in more extensive use of steel castings.

A panel composed of incoming president Moriarty and past presidents A. M. Andorn, Penn Steel Castings Co., H. A. Forsberg, Foundry & Mill Machinery Div., Blaw-Knox Co., and T. H. Shartle, Texas Electric Steel Casting Co., discussed "The Society in the Decade of the 60s."

Mr. Moriarty said that the paramount task for the society in the 60s is marketing and sales. He prescribed a more intensive marketing program and the use of market research, product promotion, and creative selling to expand old uses and create new markets for steel castings.

Mr. Andorn reviewed the statistical information presently compiled and made available to member companies, and recommended that serious consideration be given to new statistical methods to measure maximum capacities and check efficiency.

He pointed out that changes in product mix, design, and specifications make it necessary to constant-

Receiving safety contest awards from Ross L. Gilmore are, left to right, J. D. Holtzapple, Blaw-Knox Co.; N. T. Booth, Deemer Steel Casting Co.; W. F. Jicha, Calumet Steel Castings Corp.; J. W. MacKay, American Cast Iron Pipe Co. Other winners for their 1959 records were Tonawanda Electric Steel Casting Corp., Hughes Tool Co., Eastern Malleable Iron Co. All companies were accident-free in 1959

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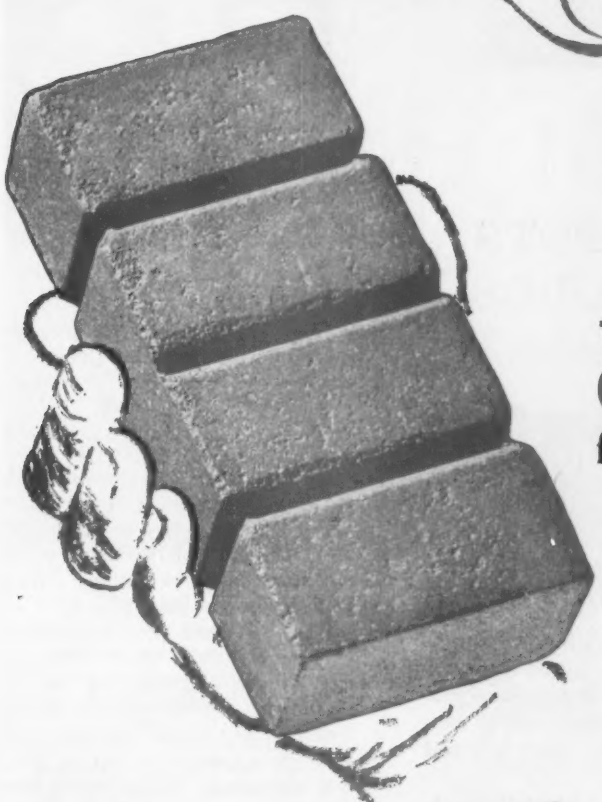

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ly re-examine statistical reporting methods. For instance, he said, today's capacity figures for steel foundries are misleading. In 1956, the industry's best year in history for sales of miscellaneous castings, operations were rated at only 68 per cent of capacity on the currently used basis. Mr. Andorn proposed that average shipments of the industry's best six consecutive months during the last five years be selected as 100 per cent of capacity.

Tracing postwar trends, Mr. Andorn said that wages have risen 400 per cent and prices only 300 per cent since 1937. Prices have increased about $2 a ton for each cent an hour upturn in wages.

Mr. Forsberg reported that during the last 15 years 45 specific research projects costing about $1 million had been initiated by the society. He urged more participation by management in research activities and the investing of a larger share of the sales dollar in research work to provide better products, cost savings, and safer working conditions.

Mr. Shartle said the 60s would demand that steel foundries make use of the information provided by the society's Management Accounting Program and seriously consider use in their plants of job evaluation, incentive plans, and job costing programs. Accurate job costing and estimating, rather than the buyer's offer, should be the basis for establishing prices, he declared.

Other speakers appearing on the program were Godfrey P. Schmidt, New York attorney, who described his experiences as a plaintiff's monitor for the International Brotherhood of Teamsters in 1958-59; Roger B. Sinclair, foundry management consultant, who explained the use of "break-even" charts in planning foundry profits; and educator Dr. Kenneth McFarland, whose luncheon talk was entitled "Who Will Succeed in the 60s?"

Nino Davi

John C. Wallfred

Winners of the Gustav A. Lillieqvist Awards for best technical papers

Dr. McFarland pointed out that for the first time since 1929, the free enterprise system has the opportunity to operate without the interference of unusual conditions imposed by a depression, war, or postwar shortages. Today, with productive capacity ample, the buyer again is in command, and business success will demand hard work and effective selling.

Clyde B. Jenni, chief metallurgist of General Steel Castings Corp., was awarded the annual Technical and Operating Medal in recognition of his outstanding contributions to the steel castings industry. Nino Davi, Pacific Steel Castings Co., won top honor for his technical paper, "A New Synthetic Sand Binder," in the Gustav A. Lillieqvist

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Acme melting pots and ingot molds assure even heat distribution without hot spots . . . they improve non-ferrous casting quality and put a damper on rejects. Cast of a specially developed iron alloy, Acme pots and molds provide great strength and unusual resistance to high temperatures, too. As a result they consistently reduce down time and substantially cut replacement costs.

Stocked in forty sizes and a complete range of styles, you can standardize on Acme melting pots and molds and be confident of immediate shipment at all times! Take advantage of all these benefits . . . proven over a period of more than 30 years.

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Quick delivery anywhere in the United States eliminates your "stand-by" non-ferrous pot and mold inventory. Write for bulletin listing all sizes and styles.

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Circle 618 on Page 53

STOP PAYING FOR EQUIPMENT YOU DON'T HAVE

The HEATALL has no equal for heating efficiency and economy!

FOUNDRIES FIND HEATING OWN SAND IS EASIER, FASTER, MORE PROFITABLE

with the

MODEL 805 *Heatall*

HEAVY-DUTY HEATER DRUM (all welded construction) contains lifting flights, burner system, and combustion chamber. As the drum rotates, the lifting flights lift the sand and drop it in a thin veil, exposing each grain to a blast of hot gasses. Thermocouple accurately records temperature at all times.

Full Flame Automatic Gas Burner System. F.M. or F.I.A. Specifications.

Now *all* foundries can efficiently and economically heat their own sand for the hot-coat process. The reason: The model 805 "HEATALL" shell sand heater. Easily installed beside any conventional muller, the "HEATALL" discharges the heated sand into the muller. The hot-coating process cuts down your cycle to *5 minutes or less.*

Standard Model 805

Heats 500 lbs. to 350° in 3 minutes

Rated Capacity 4 T.P.H.

The "HEATALL" gives you these added advantages:

- **Free-flowing, Lump-free, High Quality Coated Sand.**
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- **Higher Tensile Strength—Less Resin.**
- **Coated Sand "Tailored" To Your Specifications, Melt Point, and Tensile Strength Requirements.**

For full particulars write:

AVAILABLE IN LARGER MODELS UP TO 2500 LB. BATCHES

RATED CAPACITY 15 T.P.H.

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For continuous compressed air power, install the Gardner-Denver RX compressor. It assures years of reliable service . . . requires only routine attention. The sturdily engineered, dirt-free power end—that's one reason. And behind the scenes at Gardner-Denver, cleanliness in every step of assembly is another key to endurance. Rigorous testing assures years of efficient, trouble-free performance. Get the full story on RX superiority for 'round-the-clock service. Write for Bulletin HAC-40. Gardner-Denver Company, Quincy, Illinois.

Built for the long run

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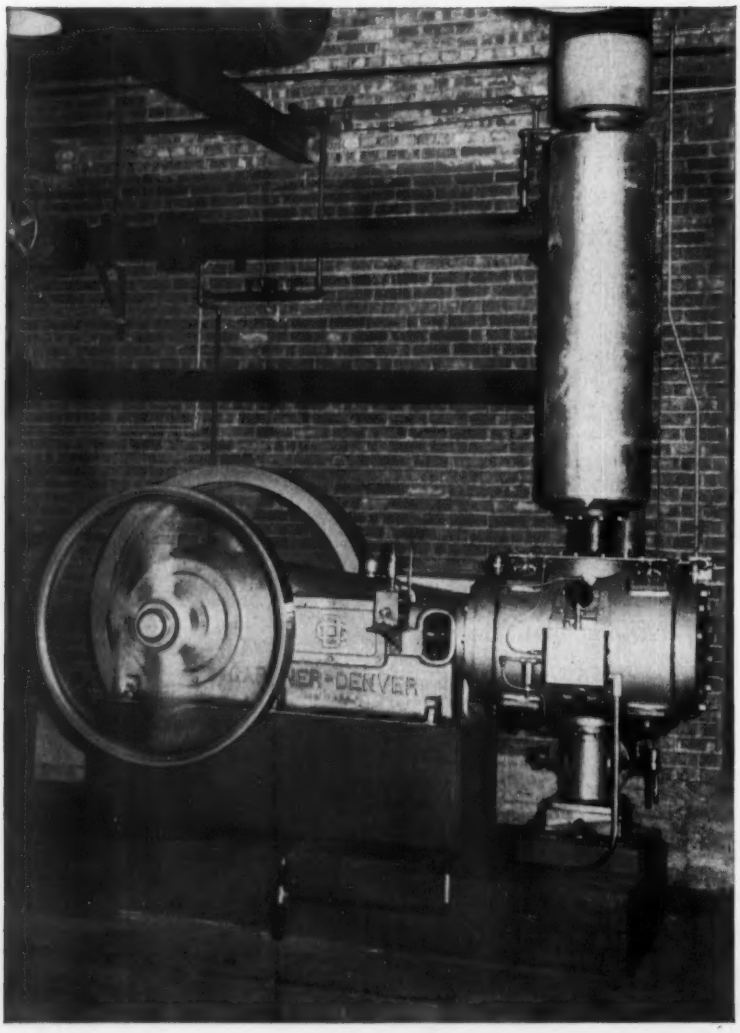

Steel Foundry Facts awards and John C. Wallfred, Minneapolis Electric Steel Castings Co., was awarded second-place honors for his paper, "The Influence of Certain Additions on Sodium Silicate Bonded Sands."

Seven companies were announced as winners of safety awards in a new contest for recognizing companies for one year of operation without a lost-time injury.

Commenting on the new contest, Safety Committee chairman J. D. Holtzapple, Blaw-Knox Co., Pittsburgh, deplored the fact that the steel casting industry's accident frequency rate of 18 compares unfavorably with the rate of 5 for all industry and the rate of 3 for steel mills. The fact that seven steel foundries have demonstrated that accidents can be eliminated, he pointed out, indicates it is possible for the industry to improve its safety record materially.

Companies which received the framed certificate for their 1959 safety achievements were: Tonawanda Electric Steel Casting Corp., Hughes Tool Co., Calumet Steel Castings Corp., Eastern Malleable Iron Co., Blaw-Knox-Wheeling Works, Deemer Steel Casting Co., and American Cast Iron Pipe Co.

Diecasters Announce Three New Engineering Standards

The American Die Casting Institute has issued three new engineering product standards on diecast threads, fillets, ribs and corners, and lettering and ornamentation.

The new standards, developed to aid product engineers in designing toward the most economic level of diecasting production, now total 16. In addition to the engineering (E) series of standards, ADCI previously published a metallurgical (M) series and a commercial (C) series.

With the new standards, the E series now covers linear dimension, parting line, and moving die part tolerances; draft requirements for walls; flatness tolerances; depth of cored holes, draft requirements in cored holes; cored holes for tapping; ejector pin marks; flash removal; angularity and concentricity tolerances; machining stock allowances; diecast threads; fillets; ribs and

Circle 620 on Page 53

corners, and lettering and ornamentation.

The M series consists of 12 pages including standards on compositions, properties, and characteristics of aluminum, zinc, brass, and magnesium diecastings, with cross-reference charts. Also included in this series is an explanation of the certified zinc alloy plan for diecasting, a voluntary control program sponsored by the ADCI to insure top performance of zinc diecastings.

The C series of product standards discusses the normal trade practices of the custom diecasting industry.

The three new standards, as well as all previous standards, are available from any company which is a member of the ADCI. Complete sets of product standards in hard-covered binders may be obtained from the American Die Casting Institute, 366 Madison Ave., New York 17, N. Y., for $5 each.

Eddy-Rucker-Nickels Offers Article on Incentives

The Eddy - Rucker - Nickels Co., Cambridge, Mass., is offering copies of reprints of an article entitled "Making Incentives Work." This article, written by Frances Torbert, professor of management, San Diego State College, San Diego, Calif., is from *Harvard Business Review*, September-October, 1959.

In the article, Professor Torbert discusses problems encountered in the use of individual incentives and shows the potential advantages of an incentive program.

For copies of the reprint, write to the Eddy-Rucker-Nickels Co., Harvard Square, Cambridge 38, Mass.

Book Review

Elevated Temperature Properties of Cast Iron **by J. R. Kattus and Bryan McPherson, paper, 96 pages, 8½ x 11 in., published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3. Price $4.25.**

In a research project the properties of six commercial low-alloy gray irons and one unalloyed ferritic nodular iron were evaluated at 800 and 1000° F by metallographic examination, tension, creep-

Team Push-Pull Power...

lift and load faster

Saving time and muscle, a Gardner-Denver "Hoistractor" and air hoist team up to provide economical push-pull power in handling heavy plant loads like this. One man, using only one hand, controls the entire operation.

The Gardner-Denver "Hoistractor" is an air-powered hoist trolley connected to the hoist by a drawbar. Both units ride the same beam. Hoist lifts and lowers . . . "Hoistractor" moves hoist *and* load along the beam.

This unusual combination of Gardner-Denver "Hoistractor" and hoist teams two-way power for faster, cheaper material handling. Write for bulletins.

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Circle 621 on Page 53

TOUSEY
VARNISH
COMPANY
Ray Lovelace Smith

Our 75th year

CHAPTER ONE

The Constitution of the United States was a brief 110 years old when Chester A. Tousey founded the Tousey Varnish Co. in 1885.

The great Chicago fire had become history and a new faith in the future of this midwest metropolis was flourishing. Mr. Tousey was possessed with an abundance of this belief when he constructed his modest plant at 560 South Canal Street. He comprised the entire staff in the beginning, producing, delivering and selling Tousey products.

The next ten years passed rapidly, increased sales and managerial problems brought an expanded staff and need for large quarters. Thus in 1895, the company moved into a new establishment at 520 West 25th Street.

The pattern of expansion in both personnel and production facilities continued. New products were added to the ever growing line and close to the turn of the century a laboratory was set up and operated on a full-time basis for product research. A three story building was added to the existing plant and large storage tanks were placed underground.

Thus Tousey, with these evidences of a healthy growing company passed through the first stages of its history.

Individual attention to customers' needs, dedication to the manufacturing of quality products and a sincere effort to maintain these standards at all times proved a successful formula for expansion.

(to be continued)

Tousey Varnish Co. manufactures a full line of finishes for application by Dipping, Flo-coating, Hot Dipping, Automatic Spray, Electrostatic Spray, Airless and Hot Spray. Tousey is a major supplier of finishes to manufacturers of Farm Machinery, Road and Construction Machinery, Automobile and Trucks, also representative manufacturers of products made of metal.

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Circle 622 on Page 53

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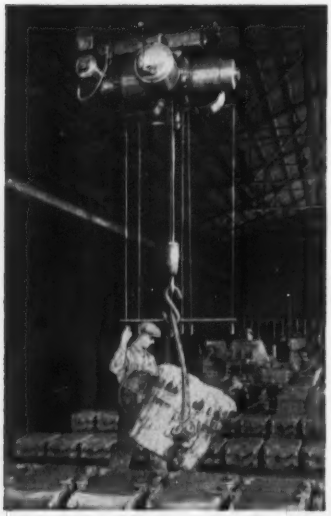
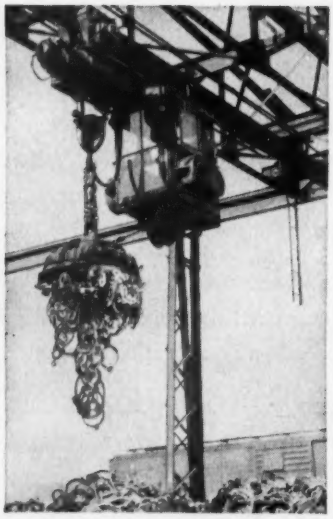
HOISTS

CUT HANDLING COSTS

in YOUR plant with the right hoist



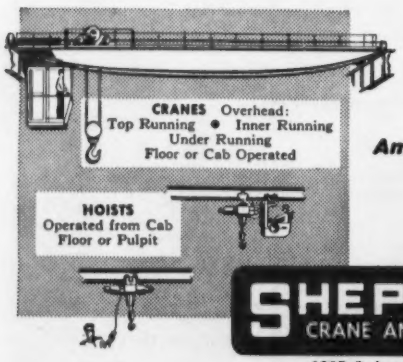
FLOOR-OPERATED HOIST
Operator primarily occupied with other duties, uses hoist for fast, efficient short hauls.



CAB-OPERATED HOIST
Cab operator moves loads at high speeds, can quickly spot material for handling.

WHICH Shepard Niles hoist fits your plant's needs . . . a floor-operated hoist where the operator is freed for other duties or a cab-operated hoist where the operator is engaged full time moving loads through the air? Shepard Niles manufactures both types in capacities from 1 to 20 tons.

Send for the descriptive bulletins on both Cab and Floor Operated Hoists . . . or ask that a Shepard Niles representative call — there's NO OBLIGATION.



Building
America's Most Complete Line of Cranes and Hoists Since 1903

SHEPARD NILES
CRANE AND HOIST CORPORATION
1395 Schuyler Ave., Montour Falls, N.Y.

rupture, thermal shock, and growth tests. Both as-cast and annealed structures were investigated.

The project, begun in 1954, was sponsored by the ASTM-ASME Joint Committee on Effect of Temperature on the Properties of Metals. Its objective was to determine the suitability of cast iron alloys for load carrying applications in the 700 to 1000° F range. Results of tests are presented clearly and illustrated by graphs, tables, and micrographs.

GE Announces Winners of Casting Conversion Contest

Grand prize in General Electric's "Convert to Castings" contest netted $500 for four men of the Small Steam Turbine Dept. for their suggestion that steel wheel casings be cast instead of fabricated.

L. E. Santerre, L. T. Janowski, H. G. Laakso, and T. A. Flint each received $125 as part of the top prize. The suggestion will save the company approximately $48,597 annually.

All told, 20 men won a total of $1900 for ideas which show how castings can save GE more than $217,000 annually. A similar contest is planned for the spring and summer months and will include conversions that were too late for the recent contest.

Book Review

Management for the Smaller Company, **edited by Elizabeth Marting, cloth, 402 pages, 6¼ x 9½ in., published by the American Management Association, 1515 Broadway, New York 36. Price, $9.**

This book represents knowledge and experiences of executives and specialists of companies with fewer than 1000 employees. It offers check points for comparing company performance with results obtained by other organizations.

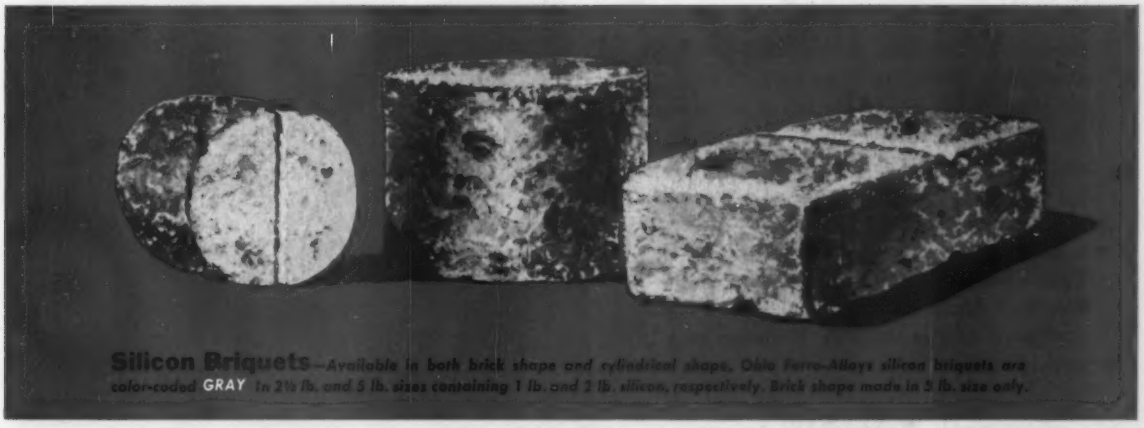
Problems in marketing, manufacturing, and finance are analyzed. Specialists deal with the area of research and development and show how a smaller company can budget a product program. Techniques for budgetary control and production control are described. Special resources available to the smaller company also are discussed.

Great New Idea for

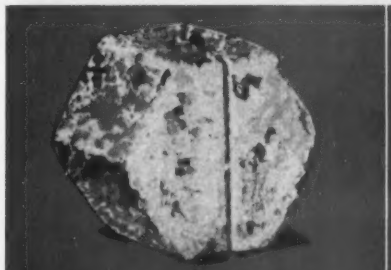
Briquet Users!

Shape Combined with Color Provides Positive Alloy Identification!

Ohio Ferro-Alloys has long followed the practice of color coding its briqueted alloys to provide swift, sure identification. Now . . . these briqueted Ohio Ferro alloys are also coded by shape to give you positive identification. Workers understand color and shape . . . you save time both in giving instructions and in avoiding errors caused by confusion. Only Ohio Ferro-Alloys brings you briqueted alloys with the twin advantages of color coding and coding by shape. And Ohio Ferro-Alloys briquets are notched without extra cost.

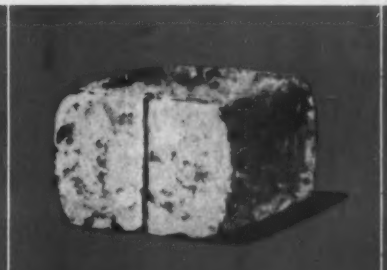


Silicon Briquets—Available in both brick shape and cylindrical shape, Ohio Ferro-Alloys silicon briquets are color-coded GRAY In 2½ lb. and 5 lb. sizes containing 1 lb. and 2 lb. silicon, respectively. Brick shape made in 5 lb. size only.



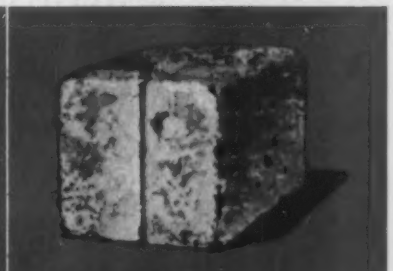
Chromium Briquets

Color-coded GREEN Ohio Ferro-Alloys chromium briquets are hexagonal in shape. 3½ lb. size contains 2 lb. chromium.



Manganese Briquets

Ohio Ferro-Alloys manganese briquets are oblong in shape and color-coded RED 3 lb. size contains 2 lb. manganese.



Silicomanganese Briquets

Square in shape, Ohio Ferro-Alloys silico-manganese briquets are color-coded YELLOW 3½ lb. size contains 2 lb. manganese, ½ lb. silicon.

New Literature!

To help show you the most efficient and economical way to use briqueted alloys, Ohio Ferro-Alloys now has available new literature. On request, your copy will be sent promptly.

QUALITY SERVICE DEPENDABILITY

Ohio Ferro-Alloys Corporation
Canton, Ohio

Birmingham Boston Chicago Denver Detroit Houston Kansas City Los Angeles Minneapolis Philadelphia Pittsburgh Salt Lake City St. Louis San Francisco Seattle Vancouver, B.C.

Thor

Everything you want in Air Grinders . . .

and more!

Thor No. 5 series heavy duty air grinders. Safest grinders ever built. 100% increase in power at no increase in weight. Remove far more metal in far less time. Positive safety control, in addition to standard governor, absolutely prevents "run-away" tools. If governor fails, air supply is cut off. Weight 10 lbs. Grip, lever or butterfly throttle. 4,500 and 6,000 r.p.m. grinding speeds.

Thor has a complete range of air grinder sizes and models. There's a Thor grinder to fit any metal removing or finishing problem. Your Thor factory representative or distributor will demonstrate. Thor Power Tool Company, Aurora, Illinois. Branches in all principal cities.

Thor POWER TOOLS

Circle 625 on Page 53

Industry Briefs

Case Institute of Technology, Cleveland, has started excavation on a $2,300,000 metallurgy building. The new facility will have twice as much space as the present building, which will be torn down. The six-story building, to contain 71,450 sq ft of floor space, will have modern foundry facilities.

WKM Div., ACF Industries Inc., has closed its 150,000-sq-ft foundry at Richmond, Tex., because it feels it is more economical to purchase castings than to make them. The division will continue to make valves and fittings at its Missouri City, Tex., plant. The company reportedly plans to sell the castings plant.

Aluminum Association reports that total primary aluminum production in the United States in 1959 was 1,953,039 tons, compared with 1,565,556 tons in 1958.

Cooper-Bessemer of Canada Ltd., subsidiary of Cooper - Bessemer Corp., will begin manufacturing operations in a plant leased from the Canadian National Railways at Stratford, Ontario. Plans call for the immediate use of 60,000 sq ft of the 200,000 sq ft capacity of the plant. Employment will start at less than 100 people. The Canadian business will gradually expand until the entire shop is used.

Master Power Corp., subsidiary of Black & Decker Mfg. Co., Towson, Md., has purchased 14 acres of land on Cochran Road, Solon, Ohio, for construction of a $700,000, one-story factory and office building to contain 50,400 sq ft. The present plant has been sold and will be vacated when the new facilities are completed.

Jeffrey Mfg. Co., Columbus, Ohio, has opened a branch office at 2119 S. Atlantic Blvd., Los Angeles, Calif. Keith Beachler, formerly with the San Francisco district office, will head the new branch.

Positioning Equipment Div., Worthington Corp., has been sold to a group headed by Paul Galton. Mr. Galton head of the former Positioning Equipment Div., is general manager of the new firm, Ransome Co., Scotch Plains, N. J.

Lorain Works, National Tube Div., United States Steel Corp., Lorain, Ohio, has established a new world safety record in the steel industry of more than 9½ million manhours worked without a disabling injury. The plant includes a gray iron and brass foundry.

Detroit Gray Iron & Steel Foundries Inc. has acquired a license from the Shaw Process Div., British Industries Corp., and plans to manufacture precision iron and steel dies and castings. The company also acquired all capital stock of Florida Gears & Systems recently.

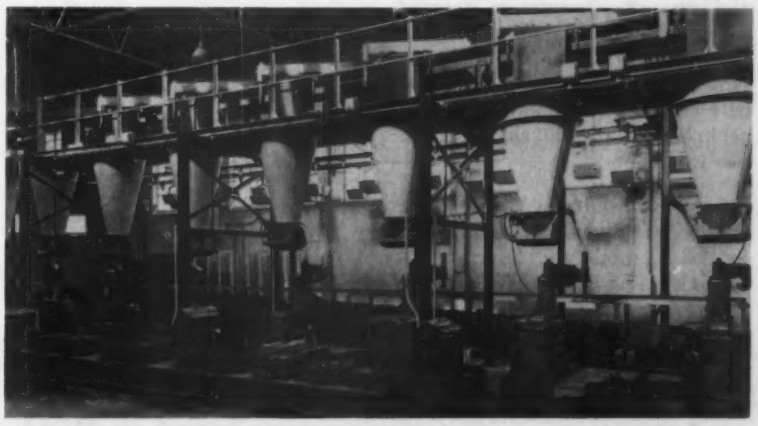
Textron Inc., Providence, R. I., has acquired the business of Amsler Morton Corp., Pittsburgh, its American affiliates, and the new division's interest in its Canadian associates. Amsler Morton will be operated as a division with no major changes in policies or management.

Durez Plastics Div. and Western Chemical Div., Hooker Chemical Corp., Niagara Falls, N. Y., have moved their Los Angeles sales offices to 6277 E. Slauson Ave., Los Angeles 2, Calif. The offices are to be consolidated with facilities for the company's products in the warehouse of Interamerican Warehouse Corp. at that location.

Castings Inc. has begun operations at 50 W. Columbus St., Mount Sterling, Ohio. The firm makes aluminum and brass castings and will provide x-ray, anodizing, and aluminum heat treating facilities.

Unit Crane & Shovel Corp., Milwaukee, has completed arrangements with Steel & Co. Ltd., Sunderland, England, to give Unit distribution and manufacturing rights under license for the Coles all-electric, gas, or diesel-driven mobile cranes in the United States, Canada, and Mexico.

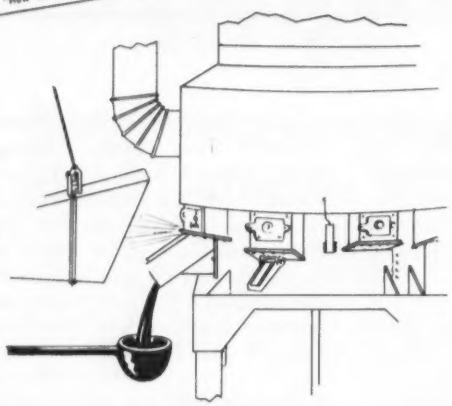
Duriron Co., Dayton, Ohio, has acquired Modern Industrial Plastics, Dayton, in which it has had a financial interest since the company's formation in 1953. A user of plastic materials in its manufac-



GORHAM ELECTRONICS, division of Gorham Mfg. Co., Providence, R. I., will spend almost $200,000 to modernize its microwave foundry facilities. New melting furnaces and automatic sand handling and molding equipment are being installed as part of the program. Investment casting facilities were put in last year at the start of the expansion, which is to be completed by July 1 of this year

HOW To Do It

FOUNDRY will pay a minimum of $15 for each "How To Do It" idea submitted and published



Slag Protects Ladles

By HARLEY SCOGGINS
Foundry Superintendent
Fort Worth Steel & Machinery Co.
Dallas

SMALL HAND LADLES usually are used in foundries for pouring chill samples from furnace heats. To prevent the ladles from burning, hold them in the slag stream coming from the furnace until they are completely covered with slag, and then let them cool. This slag lining is long lasting, and it will protect your small ladles.

tured products, Duriron will start construction of a new $600,000 plant for the division this spring at either Dayton or in Angola, N. Y.

Sundstrand Corp., Rockford, Ill., has acquired Thayer Scale Corp., Pembroke, Mass., and will operate the latter as a subsidiary with Howard Earl, president, and Carl Peterson, general sales manager. Thayer manufactures industrial processing scales.

Denton & Anderson, 9 S. Clinton St., Chicago 6, Ill., has been named sales and service representative in northern Illinois and northern Indiana for Induction Heating Corp., Brooklyn, N. Y.

Foundrymatic International Corp., manufacturer of foundry equipment, c/o Maggin and Swan (filer of papers), 509 Madison Ave., New York 22, N. Y., has been granted a charter of incorporation listing capital stock of 200 shares of no par value.

Superior Electrocast Foundry Co., South San Francisco, Calif., has formed a subsidiary, Superior Alloys Co., 150 Harbor Way, South San Francisco, Calif., to produce stainless steel castings. Colin Taylor, formerly foundry engineer, Curtiss-Wright Corp., Buffalo, has been named foundry superintendent.

Durez Plastics Div., Hooker Chemical Corp., has opened a new sales office at 333 W. First St., Dayton, Ohio, to serve Alabama, Mississippi, Ohio, most of Indiana and Michigan, and parts of Tennessee and West Virginia. The division sales office in Kenton, Ohio, has been discontinued.

Crane Co., Chicago, has purchased the operating assets of National-U.S. Radiator Corp., Johnstown, Pa., for more than $15 million. Facilities of the new acquisition will be integrated into the Crane organization. The National-U. S. name will be kept, and T. B. Focke, former president, will join Crane Co. Shareholders of National-U.S. approved the formation of a new company, Natus Corp., which W. T. Golden, chairman, National-U. S. Radiator Corp., will head as chairman.

Eastern Gas & Fuel Associates, Boston, will discontinue operations of its coke and gas manufacturing plant in Everett, Mass., on April 30.

Houghton Laboratories, Olean, N. Y., has changed its name to Hysol Corp.

Allied Foundry Products Inc., c/o Donald Spiesman, 225 Parkside Ave., Brooklyn, N. Y., has been granted a charter of incorporation listing capital stock of 200 shares of no par value.

Westinghouse Air Brake Co., Milwaukee, will consolidate its Le Roi Division operations in West Allis, Wis., Greenwich, Ohio, and certain functions of its Cleveland plant into one operating unit at Sidney, Ohio. The new unit will begin operations in the early spring of this year, but engineering and sales departments will remain at West Allis until the end of the year.

H. K. Porter Co., Pittsburgh, will invest approximately $4 million in new construction and equipment modernization of its Refractories Division plants at Bessemer, Ala., and Wellsville, Ohio.

International Foundry Supply Co. has moved its office and warehouse to 545 N. Third St., Reading, Pa.

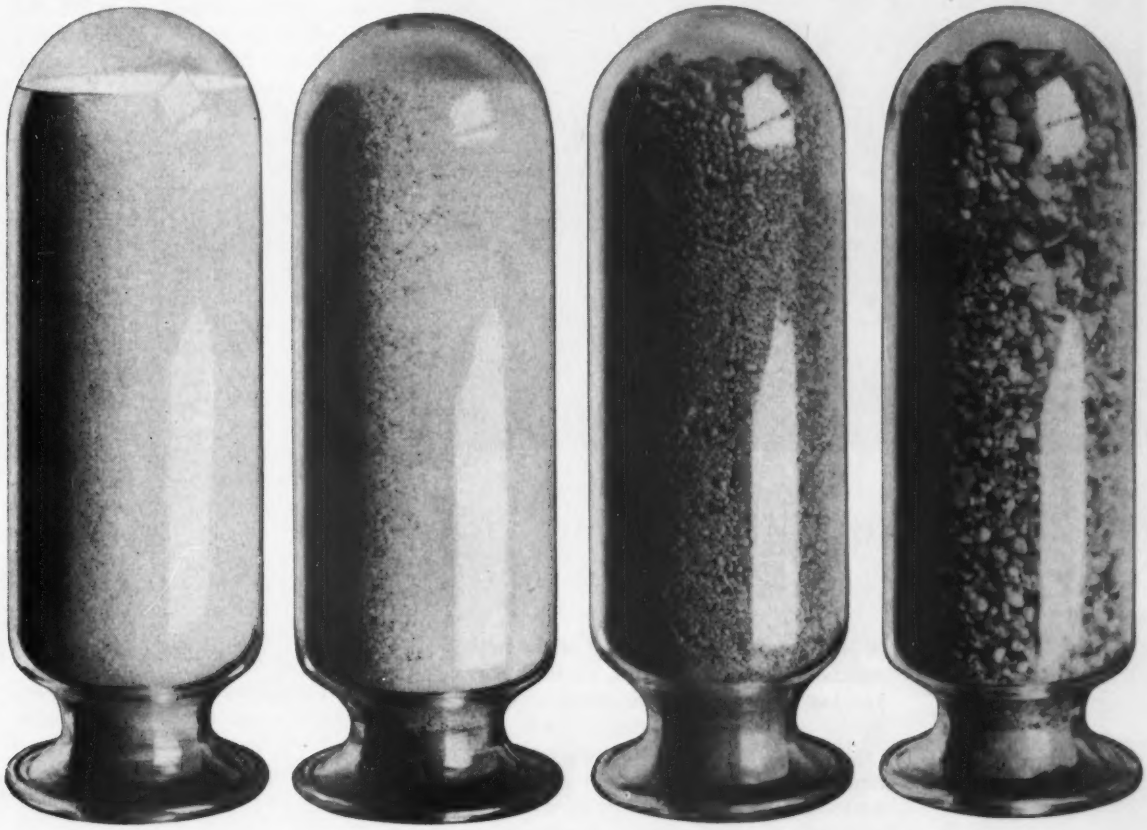
Enterprise Foundry Inc., 834 Prudential Bldg., Buffalo 2, N. Y., has been granted a charter of incorporation listing capital stock of 200 shares of no par value.

Kaiser Aluminum & Chemical Sales Inc., Oakland, Calif., has appointed Michigan Standard Alloys Sales Co., 1256 Milton St., Benton Harbor, Mich., an ingot distributor.

Smitt Industries Inc., Phoenix, Ariz., has filed articles of incorporation listing $1 million capitalization to conduct and carry on a general foundry, machine shop, and manufacturing business.

Aeroquip Corp., Jackson, Mich., has appointed eight new industrial distributors. They are Moorman Equipment Co., 3028 Mt. Vernon Ave., Cedar Rapids, Iowa; Cummins

Now Pennsylvania Glass Sand offers 35 grades of these foundry sands!



Shell-Molding Core & Molding Semibonded Silica Gravel

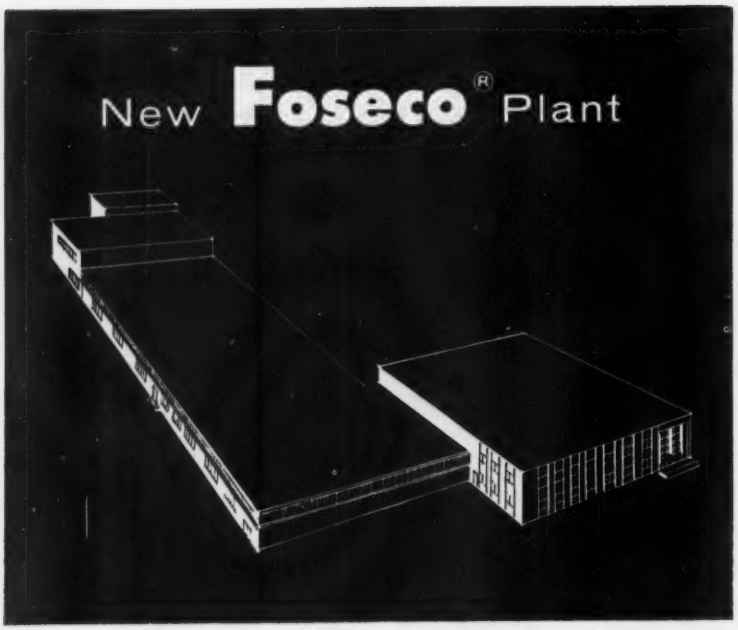
Now you can select the sand just right for your casting requirements from our expanded line of foundry sands. Or, we can blend special grades of our new core and molding sands to meet your exact specifications. And, as always, our Supersil silica flour is available in a complete range of grades. So, think of Pennsylvania Glass Sand when you need sand or silica flour for any job.

Pennsylvania Glass Sand Corporation

Industrial Silica Division • Pioneer Silica Products Co.

Sales Offices: 375 Park Ave., New York 22, N.Y. • 2 Gateway Center, Pittsburgh 22, Pa. • 8000 Bonhomme Ave., St. Louis 5, Mo. • 292 Meadows Bldg., Dallas 6, Tex.

Plants: Newport, N. J. • Mapleton, Pa. • McVeytown, Pa. • Utica, Pa. • Berkeley Springs, W. Va. • Dundee, Ohio
Geauga Lake, Ohio • Jackson, Ohio • Phalanx, Ohio • Klondike, Mo. • Pacific, Mo. • Mill Creek, Okla.



makes quality and service better-than-ever

■ Now located near the heart of the nation's expanding foundry industry, Foundry Services, Inc. looks forward to closer customer relations in the best Foseco tradition. A new experimental foundry, well-equipped laboratory and spacious production plant provide up-to-the minute facilities for the manufacture of Foseco products. Here, an expanded research and development section will develop significant new products, discover new methods to overcome casting defects and improve foundry operations. Foseco's growth is dynamic proof of Foseco quality—recognized the world over.

Visit our booth at the American Foundrymen's Society Convention, Philadelphia
Booths #943, 1042, 1043, and 1142

A world-wide organization serving the chemical and metallurgical needs of the entire metal casting industry.

Foseco®

EXOTHERMIC RISER COMPOUNDS • PROTECTIVE AND DROSSING FLUXES • DEGASSERS • ALLOYING ADDITIVES • COATINGS • DEOXIDIZERS • INOCULANTS • GRAIN REFINERS

Foundry Services, Inc.
P.O. Box 8728 Cleveland 35, Ohio
Telephone: BErea 4-3551

Diesel Sales Corp., 4401 E. Hillsborough Ave., Tampa, Fla.; L. E. Fox Co. Inc., 1924 E. 30th St., Kansas City 9, Mo.; Central Supply Co. Inc., 705 Natchitoches St., West Monroe, La.; Geheb Electric & Industrial Supply Co., 206-208 S. Cherokee, Muskogee, Okla.; Southern Supply Co., Jackson, Tenn.; Hoener Equipment Co., 925 Hampshire St., Quincy, Ill.; and CKM Industries, 3038 Madison Rd., Cincinnati 9, Ohio.

Industrial Heating Equipment Association Inc. reports new orders for industrial heating equipment in January totaled $6,827,000, a 50 per cent increase over January, 1959. Total net new orders in January for induction heating equipment came to $1,068,000.

Standard Refractories Ltd., with offices in Hamilton and Toronto, Ontario, Canada, has been appointed distributor for J. H. France Refractories Co., Snow Shoe, Pa. The new distributor will handle France sales in the provinces of Ontario and Quebec.

Wheelabrator Corp., Mishawaka, Ind., has acquired about 80 per cent of the controlling stock of Lord Chemical Corp., York, Pa. Lord will continue to make its line of vibratory and barrel-type finishing equipment at York. Wheelabrator entered that field in 1958, when it organized its Techline Div., Vicksburg, Mich., specialists in wet blasting and barrel finishing.

J. O. Ross Engineering Div., Midland-Ross Corp. is constructing a building at 13050 Puritan Ave., Detroit, for engineering and office personnel of Ross and representatives of Midland-Ross. The building is to be completed this month.

Luria Brothers & Co. Inc. has moved to its own new headquarters building at 130 Presidential Blvd. N., Bala Cynwyd, Pa. The one-story building has 11,000 sq ft of floor space.

Structa-Lung Co., Willoughby, Ohio, manufacturer of power roof ventilators, has appointed Crosby Foundry Sales Co., Cleveland, as its sales representative for Ohio.

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Circle 628 on Page 53→

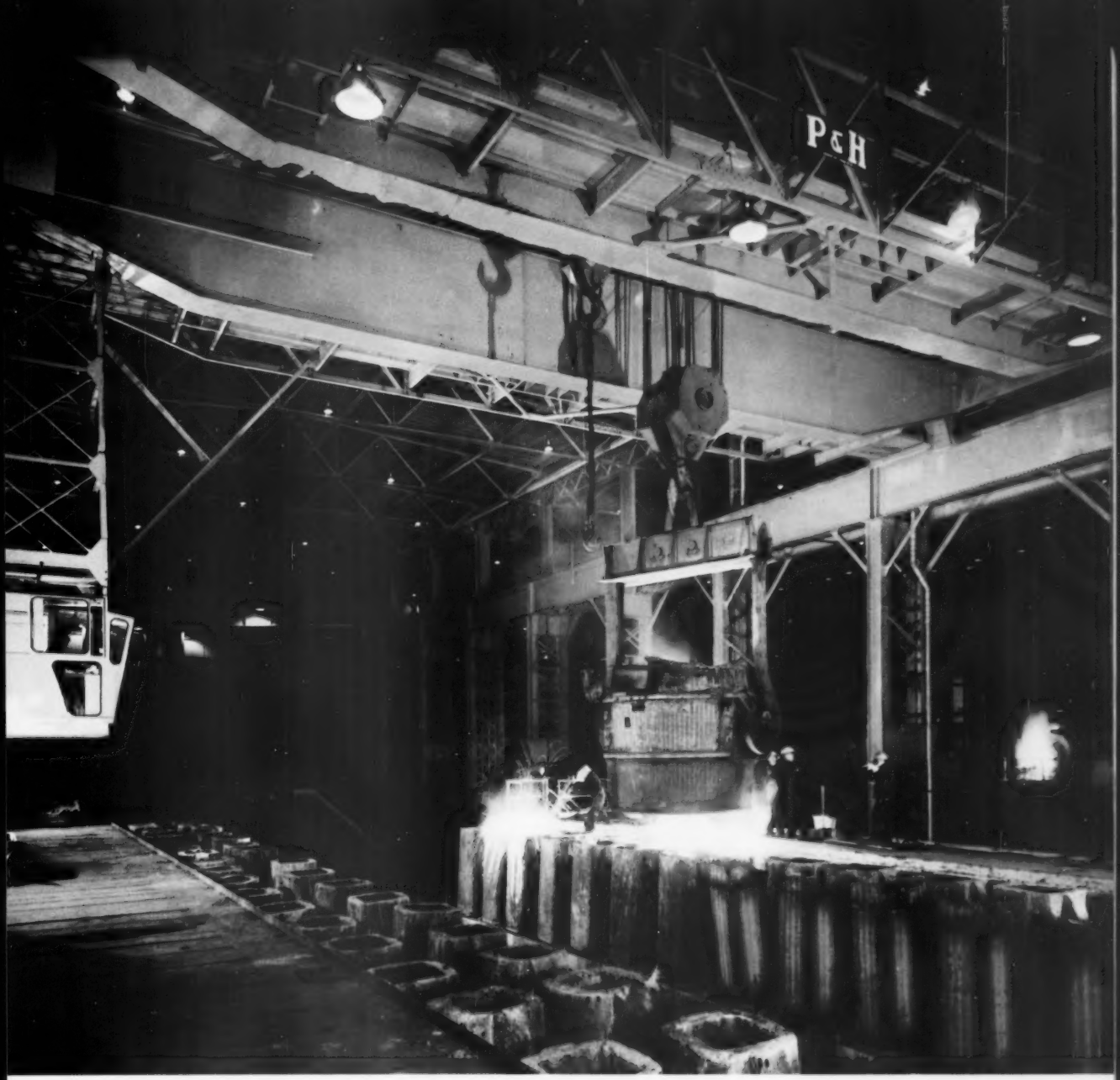


Photo courtesy Acme Steel Company, Riverdale, Illinois.

FOR EVERY APPLICATION, THERE'S ONE CRANE OUTSTANDING...

IN STEEL MILLS: This 100-ton P&H crane lifts, transports and "spots" tremendous loads of molten steel as surely and deftly as you handle a coffee cup.

P&H steel mill cranes perform tasks like this effortlessly and dependably because they are specifically designed for steel mill service . . . to handle massive loads, withstand searing heat, ignore frequent shock loads.

What's more, P&H carefully engineers every crane to meet specific job requirements . . . to consider all factors affecting performance. Special operating problems are taken in stride. Result: P&H cranes chalk up almost unbelievable service records month after month, year after year, decade after decade.

Isn't this the kind of performance you want, too? Write for bulletin C-42 to Dept. 120, Harnischfeger Corporation, Milwaukee 46, Wis.

P&H enclosed cabs have full-view safety glass windows, for unrestricted view of work area. Cabs can be heated and air conditioned where cold, heat, smoke or fumes render ordinary cabs uncomfortable or unsafe.

P&H
OVERHEAD CRANES

HARNISCHFEGER
Milwaukee 46, Wisconsin

Photo: Courtesy Isaacson Iron Works Co., Seattle, Washington

P&H PRECISION CONTROL SPOTS HEAVY STEEL ACCURATELY, SAFELY

This West Coast steel-fabricating company depends on P&H Balanced Design Hevi-Lift hoists to keep heavy steel beams and fabricated structures moving through its shops.

Note the unique method of installation which provides a high degree of flexibility . . . hoists can be used alone — or hoists can be teamed up to handle extra-long sections.

This company selected P&H Balanced Design Hevi-Lifts because they will stand up longer, under heavier duty cycles — with less maintenance — than any other hoist they could buy. Reason: Balanced Design means that every component has been balanced with every other component for maximum strength and performance characteristics.

If uninterrupted through-the-air material handling is important to you, too, then it will pay you to find out more about these new hoists. Send for bulletin H-55, Dept. 222, Harnischfeger Corporation, Milwaukee 46, Wis.

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H
HEVI-LIFT
HOISTS

Betsy Ross's home, where the first American flag was made, is one of many tourist attractions in Philadelphia, where the 1960 AFS Castings Congress and Exposition will be held from May 9 to 13

Foundry Industry Will Gather at AFS

CASTINGS CONGRESS AND EXPOSITION

● FINAL FORM of the 1960 AFS Castings Congress and Exposition, which will be held May 9-13 at Convention Hall, Philadelphia, is taking shape as the opening day approaches.

As of Mar. 1, almost 240 exhibitors had signed up for space in which to display the full range of new equipment, processes, and techniques for the foundry industry. It is anticipated that nearly 300 companies will occupy the 100,000 sq ft of space available in the hall, and approximately 15,000 foundrymen are expected to be on hand during the week-long show. Scope of the exposition is indicated by the fact that the exhibitors already scheduled make up a larger number than those who participated in the last show, in Cleveland in 1958. The 1960 group includes companies with headquarters in England, Belgium, Holland, Switzerland, and Germany.

AFS reports that this show will present considerably more new equipment and supplies than usual. These developments include melting units, including vacuum melting; new types of conveyors; pneumatic sand conveying; and new laboratory shakeout conveyors. There also will be many shell molding and CO_2 process exhibits, coreshooters, and a fully automatic molding setup.

As always, operating exhibits will be a feature of the show. In addition to demonstrations of individual units of equipment covering a wide variety of foundry practices, the displays will include both a ferrous and nonferrous operating foundry.

A feature will be two theaters, the Independence Theater, and the Liberty Theater. These will offer special schedules of programs by exhibitors who will show applications of their supplies and equipment and provide information concerning them. Some will conduct modified seminars including actual laboratory techniques. Each exhibitor will have approximately 1 hour on a definite schedule, which will be printed in the official convention program.

New processes and techniques for application now and in the future comprise the basis for the technical papers to be presented at the 64th Castings Congress. Forty technical

TENTATIVE PROGRAM

Monday, May 9

7:30 a.m.—Author-Chairman Breakfast
8:30 a.m.—Registration
9:30 a.m. — Technical Sessions: Brass and Bronze; Light Metals; Malleable; Pattern
12 noon—Round Table Luncheons: Light Metals; Malleable
2 p.m.—Technical Sessions: Pattern; Nonferrous Symposium
4 p.m.—Technical Session: Sand
8 p.m.—Shop Courses: Malleable; Sand

Tuesday, May 10

7:30 a.m.—Author-Chairman Breakfast
8:30 a.m.—Registration
9:30 a.m.— Technical Sessions: Brass and Bronze; Malleable; Pattern; Safety, Hygiene, and Air Pollution
12 noon—Round Table Luncheons: Brass and Bronze; Pattern
2 p.m.—Technical Sessions: Education; Gray Iron; Industrial Engineering and Cost; Light Metals; Steel
4 p.m.—Technical Sessions: Gray Iron; Light Metals; Malleable; Sand
6 p.m.—Canadian Dinner; Sand Dinner
8 p.m.—Shop Courses: Gray Iron; Malleable

Wednesday, May 11

7:30 a.m.—Author-Chairman Breakfast
8:30 a.m.—Registration
9:30 a.m.—Annual Business Meeting and Annual Hoyt Lecture
12 noon—Round Table Luncheons: Diecasting and Permanent Mold; Management
2 p.m.—Technical Sessions: Diecasting and Permanent Mold; Gray Iron; Plant and Plant Equipment; Steel
4 p.m.—Technical Sessions: Diecasting and Permanent Mold; Industrial Engineering and Cost; Sand; Steel
7 p.m.—Annual AFS Banquet

Thursday, May 12

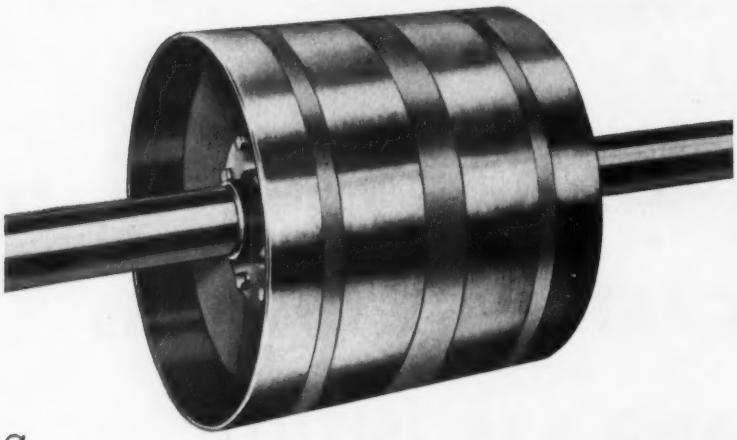
7:30 a.m.—Author-Chairman Breakfast
8:30 a.m.—Registration
9:30 a.m.—Technical Sessions: Diecasting and Permanent Mold; Ductile Iron; Fundamental Papers; Steel
12 noon—Round Table Luncheons: Ductile and Gray Iron; Steel
2 p.m.—Technical Sessions: Ductile Iron; Symposium on Solidification (Joint Heat Transfer and Fundamental Papers)
4 p.m.—Technical Sessions: Gray Iron; Sand; Steel
6 p.m.—AFS Alumni Dinner
8 p.m.—Shop Courses: Ductile Iron; Gray Iron

Friday, May 13

7:30 a.m.—Author-Chairman Breakfast
8:30 a.m.—Registration
9:30 a.m.—Technical Sessions: Ductile Iron; Fundamental Papers; Heat Transfer; Sand

←Circle 629 on Page 53

ONLY Stearns Indox V ceramic magnet pulleys give you job-proved protection

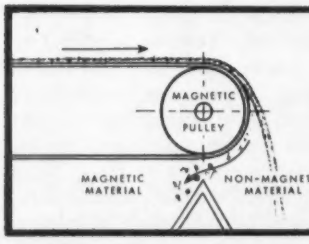


Stearns INDOX V permanent magnet pulleys are the only ceramic units field-proved on hundreds of applications in almost every industry. Both in new installations and as replacements for electromagnetic pulleys, Stearns INDOX V ceramic pulleys have performed beyond expectation as powerful stoppers of tramp iron.

RADIAL POLE DESIGN THE ANSWER

Stearns INDOX V ceramic magnet pulleys produce a powerful magnetic field that blankets the entire conveyor burden — pulling out tramp iron far more effectively than conventional units. Stearns radial pole design provides fingers of magnetism that reach out and probe every inch of the material as it speeds along the conveyor — pulling out dangerous tramp iron that could ruin process equipment and contaminate your product.

These job-proved ceramic magnet pulleys give you all the benefits of deep-field electromagnetic units with none of the extra costs. Consider these advantages: lower initial cost, no power expense, no chance of power failure, no need for rectifier, no moisture problem, minimum maintenance. Stearns Series "410" permanent magnet pulleys and Series "710" for deeper conveyor burdens are available in standard widths and diameters from 12 to 48 inches. Call your local Stearns representative for full details and a price quotation, or write for free Bulletin 1022 G.



AMAZING NEW
INDOX V PULLEY
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sessions during the week will point up the progress being made throughout the industry. In these sessions, more than 100 individual papers will cover the complete range of foundry operations. They will include material of interest to management, production, and research personnel in both small and large foundries.

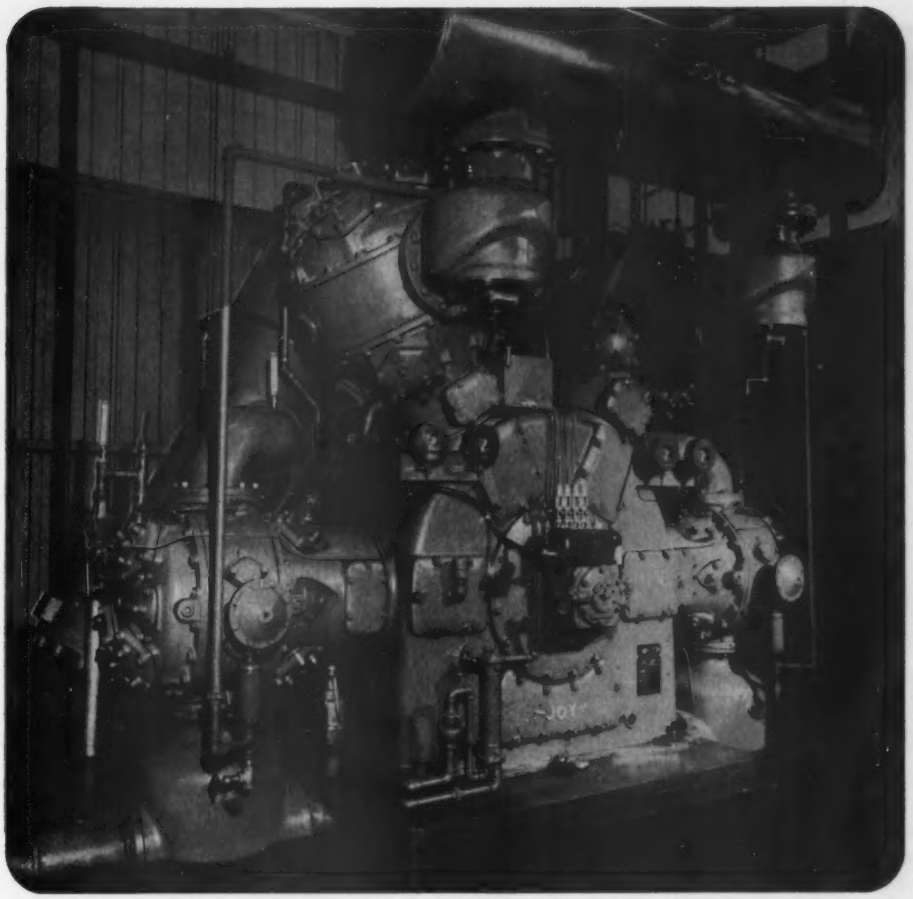
A further attraction will be an extensive plant visitation program designed to appeal to foundrymen in virtually every branch of the industry. Foundries on the schedule pour steel, high-alloy steel, Monel, malleable iron, gray iron, copper-base alloy, ductile iron, aluminum, and other castings. Molding methods include sand, centrifugal, stack, and others. Products cover a similarly wide range. Full details will be presented next month, as will the complete technical program, list of exhibitors, and other pertinent information.

NEO Chapter Holds Workshop For Industrial Arts Teachers

Apex Smelting Co., Cleveland, was host to the second Aluminum Workshop held by the educational committee of Northeastern Ohio Chapter, American Foundrymen's Society, Feb. 22. Twenty-five industrial arts instructors from greater Cleveland high schools and a professor from a nearby college attended the workshop.

Lectures covered aluminum alloy metallurgy, and demonstrations were conducted on spectographic and chemical methods of metal analysis, mechanical testing, and metallographic and radiographic testing methods. Those attending the session participated in alloy melting and fluxing procedures. They poured sand and permanent molds and operated a diecasting machine.

The workshop was arranged by James J. Schwalm, eastern sales manager, Archer-Daniels-Midland Co., Federal Foundry Supply Div., Cleveland, and Edward Trela, research metallurgist at Apex, who directed the session. Mr. Schwalm is chairman and Mr. Trela a member of the vocational guidance subcommittee of the NEO Chapter educational committee.



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Circle 631 on Page 53

Foundry Developments

By EDWIN BREMER

Metallurgical Editor

Self-Curing Binder

COMPLETELY self-curing sand binder, developed by Archer-Daniels-Midland Co., Federal Foundry Supply Div., Cleveland, is ready for the foundry market after several years of developmental work. Cores and molds made from the sand mix cure by standing in air.

Ultimate tensile strength is attained in 8 to 24 hours, depending on rate of the curing reactions, humidity, and amount of moisture in the sand. The level of strength reached also depends on these factors. However, experience gained during field tests in about 75 foundries indicates that minimum levels are within acceptable limits for good, sound cores.

The process is based on a resin-catalyst-accelerator system requiring no baking. According to the manufacturer, oxidative curing has little effect, minor temperature variations are unimportant, and moisture will not stop the curing reaction although it has some influence on the process. The curing system is said to be reliable and easy to regulate. Collapsibility, gas evolution, and casting surface finish are comparable to or better than that obtained with the company's standard air setting binder.

Consumption Figures

SOME figures of interest are presented in "Consumption of Raw Materials in the Foundry" by M. Martin and F. K. Garman which appeared in the January issue of *BCIRA Journal* (Birmingham, England).

Data gathered from 216 foundries over a period of 8 years show that coke consumption for cupolas operating less than 4 hours varied from 0.35 to 0.1 ton per ton of metal melted, and with those operating above 4 hours it was 0.22 to 0.1 ton per ton of metal melted. Seventy-five per cent of the foundries use limestone between 5 and 20 per cent of total coke used per melt. Mean consumption of ganister is 0.03 to 0.04 ton per ton of metal for less than 5 tons of metal melted, and 0.02 to 0.03 ton per ton of metal for above 5 tons of metal melted.

Eighty per cent use between 10 and 50 per cent pig iron per ton of metal melted, and 87 per cent use the same percentage for return scrap. Seventy-eight per cent of foundries use 0.04 to 0.3 ton of molding sand per ton of metal melted, and 80 per cent use below 0.2 ton of silica sand per ton of metal. Eighty-five per cent of the foundries use between 2 and 40 cwt coal dust per 100 tons of metal melted, and 76 per cent use between 1.5 and 4 per cent core binders per sand mixture.

One-shot Pattern

INVESTMENT casting foundries offer a system for inexpensively producing one or more prototype castings for evaluation purposes, according to the book, *How To Design and Buy Investment Castings*, published by the Investment Casting Institute. Procedure is to machine polystyrene to form the pattern, usually in segments which are cemented together. The pattern then is used to make an investment casting. The method also may be employed to establish the most suitable design for facilitating casting the part.

Tuyere Injection

INJECTION of calcium carbide into the tuyeres of a water-cooled, basic-lined cupola resulted in extremely low sulfur content and an appreciable pickup of carbon, according to an article "Desulphurization of Cupola Cast-Iron by Tuyere Injection of Calcium Carbide" by D. H. Eastwood and D.W.N. Pitts in the Jan. 28 issue of *Foundry Trade Journal* (London, England). In one experiment, injecting 1 lb of carbide per minute for more than 4 hours, an average sulfur content of 0.004 per cent was obtained with an indication that the carbon pickup was 0.25 per cent over the normal.

Phosphorus Effect

CONCLUSIONS drawn by K. E. L. Nicholas following a study of the effect of phosphorus on nodular graphite irons are that its presence causes severe internal porosity, tearing, and top surface piping. Phosphorus additions result in exceptionally large casting expansion. Expansion grows with increasing phosphorus content, but the largest relative expansion occurs in the low and medium phosphorus contents.

Rigid cement molds decrease casting expansion and volume of feederhead pipe, but the characteristic dispersed internal porosity of phosphoric irons remains. The solidification expansion force in medium and high phosphorus irons is sufficient to reduce the extent of the contraction observed when low phosphorus irons are cast in cement molds.

Deep etching demonstrates presence of a continuous network of phosphide eutectic surrounding the eutectic cells in irons of greater than 0.4 per cent phosphorus. Details of the study are presented in the January issue of *BCIRA Journal* (Birmingham, England) in the article "An Effect of Phosphorus on the Solidification Expansion and Soundness of Nodular Graphite Irons."

Heat Treating Steel

HEAT treating process developed by Eimco Corp., Salt Lake City, Utah, for its steel castings is called "Determinant Tempering," and is said to provide several advantages. In the process, the castings are allowed to cool in the mold to just below red heat, are shaken out, and transferred immediately to a heat treating furnace operating at a temperature sufficiently high to complete the pearlite transformation. Castings then are air-cooled and subsequently processed conventionally.

Advantages reported are elimination of cracking due to casting stresses, flame cutting, grinding, etc. Castings also are said to show significant improvement in mechanical properties.

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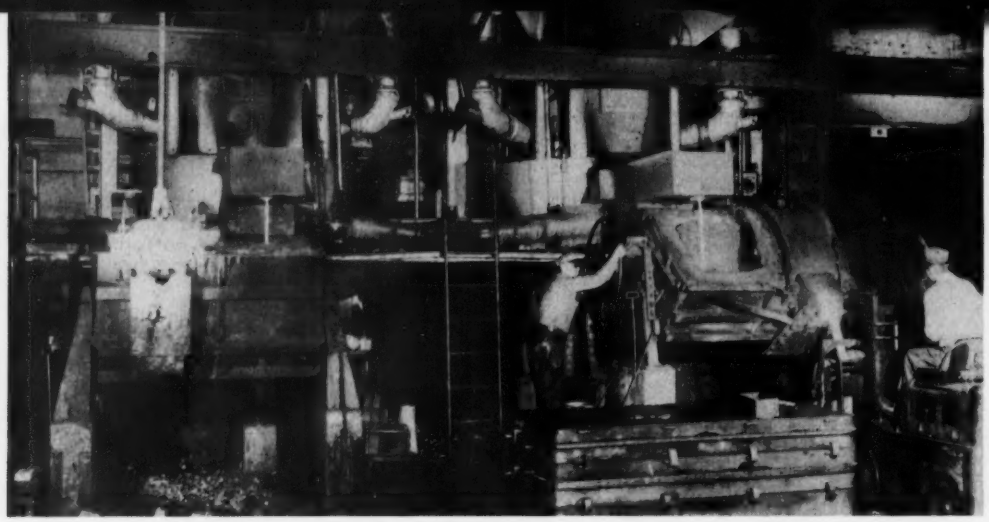


Modernization program at Neenah Foundry Co. was completed with installation of two cupolas, rated at 11 and 8 tons per hour, with water cooling and carbon-lined well

Water Cooling, Carbon Lining Promote

Flexible Cupola Operation

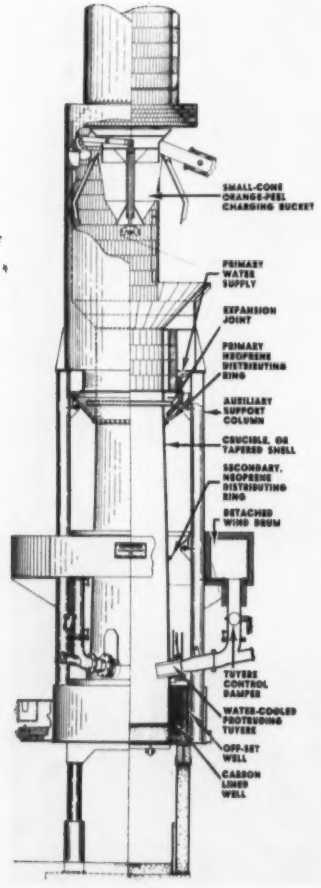


Fig. 2—Drawing shows the design used to construct the two new cupolas

● CHANGES in slag analysis from acid to basic and back again call for closely controlled conditions in foundry practice. Neenah Foundry Co., Neenah, Wis., achieves such flexibility as a matter of routine in the production of both gray and ductile iron.

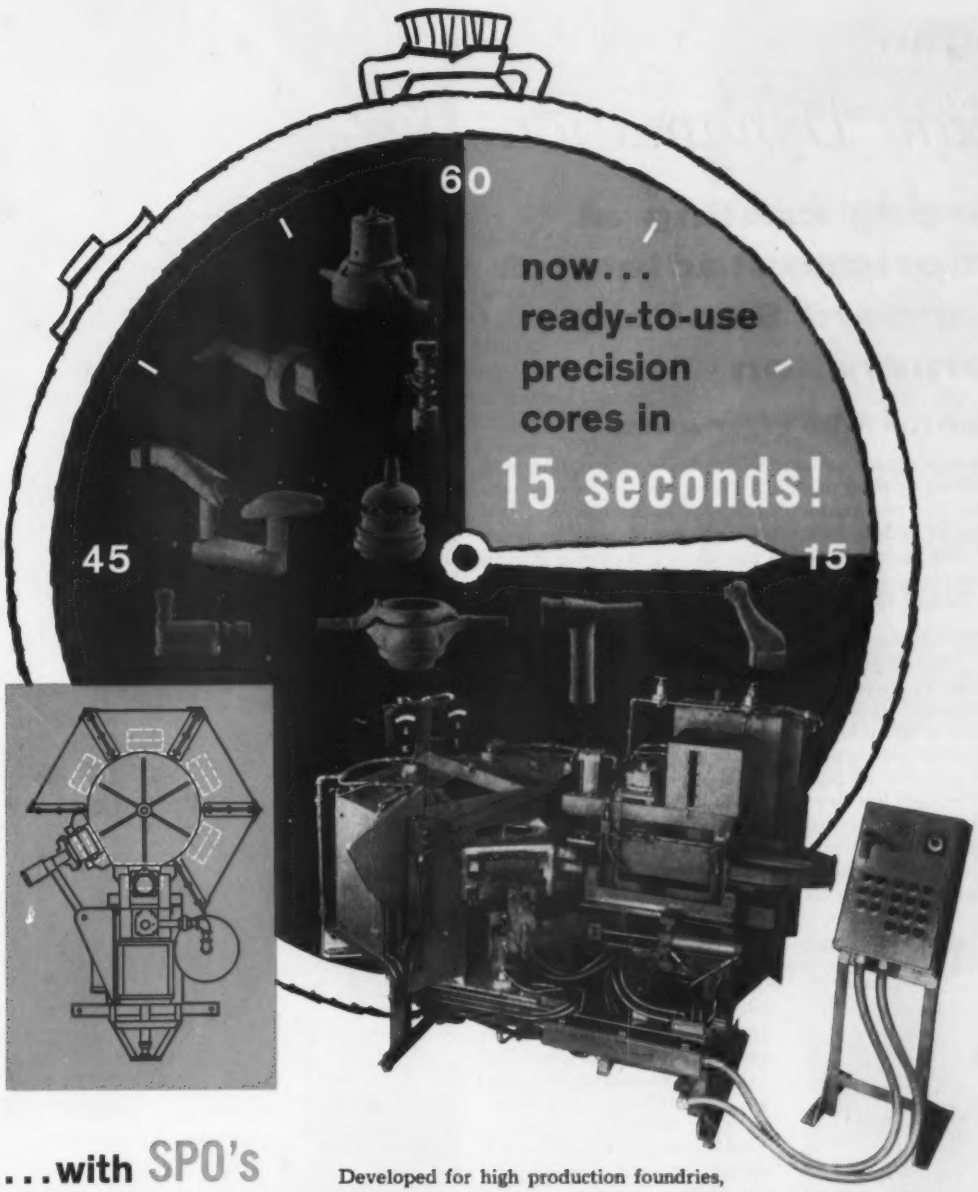
Neenah Foundry has combined the advantages of external water cooling and carbon-lined well zones to complete an extensive modernization program with the installation of two cupolas, rated at 11 and 8 tons per hour.

Providing both stabilized temperature conditions and close chemical control of the final product, Neenah's new cupolas melt directly against the steel shell in an unlined melt zone. They have a neutral lining of carbon in the well zone. A cutaway drawing illustrates the design used by Modern Equipment Co., Port Washington, Wis., to construct the two cupolas.

A variety of iron grades can be produced by controlling only the charging material—an acid slag for standard gray iron or a basic slag for high-carbon, low-sulfur ductile iron.

Water cooling in the melt zone and a carbon well-zone lining team up in cupola design to provide other economic advantages. Less expensive charging materials such as steel scrap with a low carbon content can be used, and the carbon well zone lining in conjunction with a basic slag permits production of irons with a much higher carbon content than can be accomplished with conventional acid-lined cupolas. Melting occurs against the externally water-cooled steel shell, and the operating diameter remains uniform during the heat. Maintenance of equilibrium and even temperature give improved metallurgical control.

Refractory Savings—Engineers at Modern Equipment Co. report that some foundries have found that refractory savings alone can pay for a water-cooled, carbon-lined cupola over a period of years. Acid refractory costs, for example, range from 50 to 70 cents a ton on high-production cupolas but in smaller units, with fewer tons over which to av-



...with SPO's automatic 6-station rotary holo-core machine

Developed for high production foundries, SPO's Model SC-10-R machine is capable of mass producing uniform standard hollow cores *in 15 seconds or less.* A six-station design, it will accommodate core boxes up to 10x12x6 inches in size. All operations except removal of finished cores are automatically controlled by precision valves and electrical equipment.

SPO Holo-Core machines . . . a new concept in core making equipment . . . facilitate new production techniques that assure substantially increased efficiency and economy. They can be installed as integral units in molding machine production lines because their *precision cores are ready to use only seconds after being blown.*

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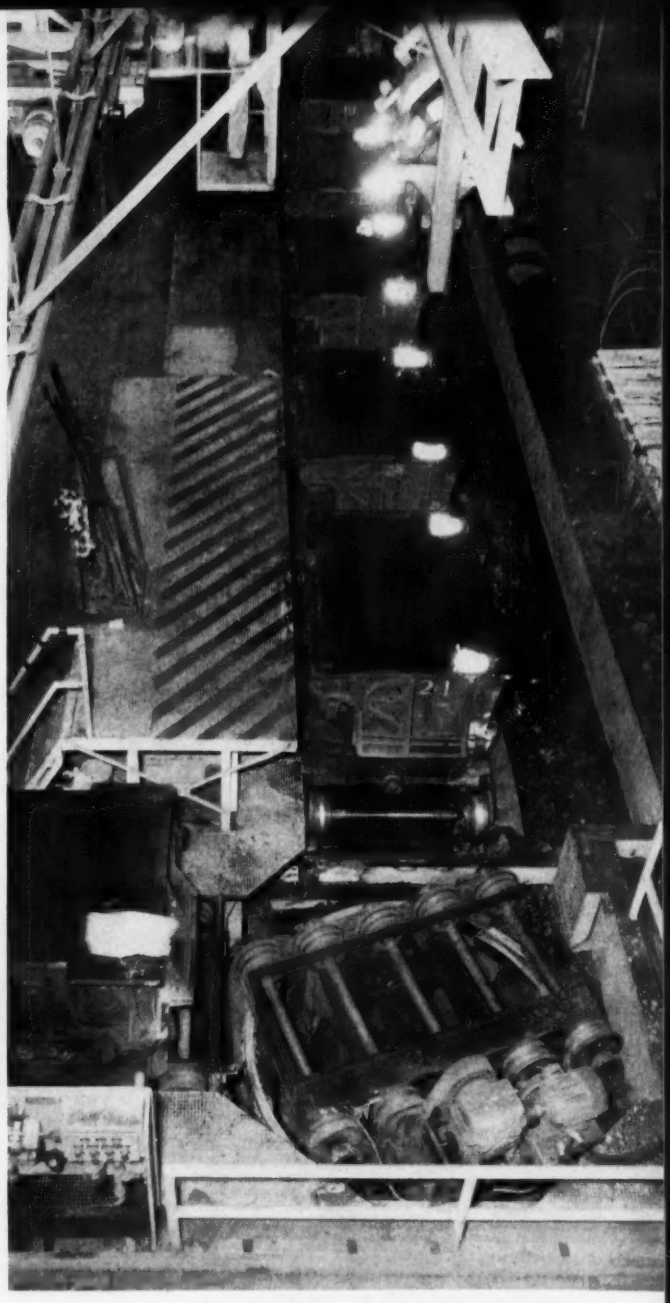
Logan *Plant Dynamation* speeds casting at American Radiator & Standard Sanitary Corporation

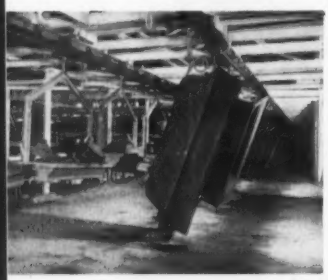


A NINE-TON MOLD EVERY MINUTE

Problem in Plant Dynamation: Advanced molding and pouring equipment offered a high *potential* rate of output for this new major foundry in Louisville, Ky. But delicate 18,000-lb. bathtub molds would have to move safely and rapidly through a U-shaped conveyor system with the metal in a molten state. And all casting had to be synchronized for fast continuous operation.

Results: The Logan conveyor engineer collaborated with foundry equipment specialists on a largely automatic system. The production pace achieved was one tub casting every minute. In actual castings produced, this means a capacity of 200 tons per 8-hr. shift.

Specially designed heavy-duty live flanged wheel conveyors give the necessary speed and smoothness. Molds glide through the two required turns on automatic air-powered turntables, with a minimum of rejects due to sand shifting. Gaps between molds in the 256-foot wheel system are eliminated by automatic indexing. Turntable shown has dispatched a mold to cooling—now returns to pick up next mold from pouring. Ladles pour during turntable's one-minute cycle.



The Integrated system completes a rectangle on the casting floor—two chain conveyors with heavy-duty saddles taking copes and drags quickly from shake-out back to the molding machine. Overhead trolley conveyors (left) carry castings through a bridge into the cleaning areas.

LOGAN CONVEYOR DESIGN HELPS HARNESS ALL THE WORK POWER OF YOUR FOUNDRY

In today's foundry, as in any modern plant, the potential productive power of men, equipment, and space can be great. But harnessing and activating this power can prove the real key to success. Full *dynamation* comes only through the one right custom-designed conveyor system.

The Logan technique of Plant Dynamation ensures this one right system. It is an exclusive conveyor design concept perfected over the half-century through which production-line industry itself has grown up. Backed by one of the most comprehensive lines of foundry conveyor equipment, our field engineer works with you to analyze the unique dynamic principles of your foundry. He draws on knowledge and equipment covering five modes of conveyor power and control to design and specify the exact system dictated by your operation.

"The Man From Logan" stationed near you has, on an average, about fourteen years experience in Logan Plant Dynamation. He works with your engineers through design and installation to smooth operation. If you are expanding or remodeling, get the *full* benefit of Logan Plant Dynamation—call "The Man From Logan" in for your earliest planning sessions. Phone or write today for a meeting with this key specialist.

Logan Conveyors

LOGAN CO., 580 CABEL ST., LOUISVILLE 6, KY.

Circle 634 on Page 53

erage the costs, acid refractory sometimes can run as high as $3 to $3.50 a ton.

Before investing in its two new cupolas, Neenah Foundry made both its gray and ductile iron in lined cupolas and therefore was limited in its selection of charging materials. The carbon-lined wells provided by the new units permit a much greater operating range, which is extremely important.

Longer Melting—Prolonged melting periods, with appreciable operating economies, are a natural for water - cooled cupolas. Neenah

Fig. 3—Carbon well zone lining is constructed of large blocks for a minimum of joint erosion. A tap hole can be seen in the center of the illustration

Foundry makes up the bottom Monday morning and doesn't drop it again until the following Friday or Saturday night.

For overnight banking following a 16-hour melting day, the cupolas are drained completely of iron and slag, the wind is shut off, and the cupola is banked with fresh coke on top of the remaining, incandescent coke bed. Sufficient coke is supplied to retain a high enough temperature for startup the next morning. This technique eliminates cleaning up the bottom drop and providing a new sand bottom daily.

Even so, less coke is required for banking than for complete daily shutdown and startup. Even if a bottom is dropped every day, says Modern Equipment Co., the cupola can be cooled quickly enough to permit preparations for the next day's heat.

As shown in an accompanying photo, the carbon well zone lining is constructed of large blocks for a minimum of joint erosion, completely eliminating horizontal joints, which can be troublesome. In the approximate center of the picture, taken immediately following installation of the lining, a tap hole can be seen.

Carbon blocks for the two cupolas at Neenah Foundry were supplied by National Carbon Co., a division of Union Carbide Corp. The well zone lining for the 11-ton cupola consists of 10 blocks, each weighing some 200 lb and measuring 9 by 22 by 25 in. Machined to close tolerances at National Carbon's plant, the blocks were installed with relative ease at the foundry. Modern Equipment reports that one foundry has produced 125,000 tons of iron with a single well zone lining.

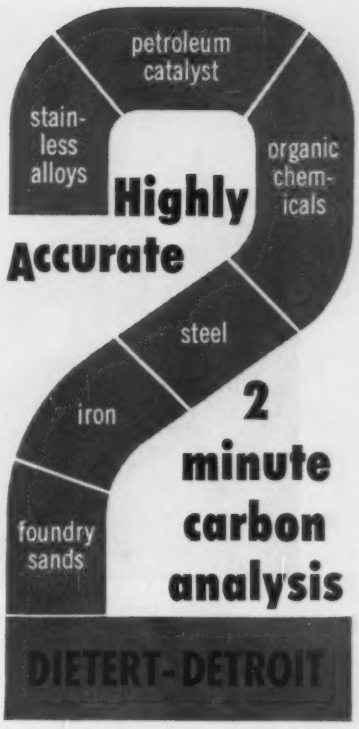
Although the externally water-cooled, carbon-lined cupola is by no means a panacea for all melting problems, its versatility, coupled with a thorough analysis of the specific application, makes it economically applicable to a wide range of operations.

ICI To Hold Design Clinic and Ceramic Materials Course

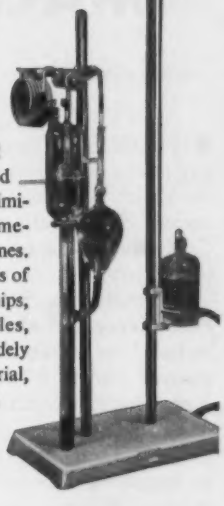
The Investment Casting Institute, Chicago, will sponsor an Eastern Design Clinic on May 9 at the Essex House, Newark, N. J. Walter A. Dubovick, Engineered Precision Casting Co., Matawan, N. J., and C. A. Crawford, ICI technical director, are in charge of the clinic. A registration fee of $10 includes luncheon and a copy of the institute's book *How to Design and Buy Investment Castings.*

A four-day course "Ceramics for Investment Casting" is being cosponsored by ICI and Alfred University, Alfred, N. Y., starting June 13. Faculty members and men from ICI member companies will lecture the sessions. The course is designed to cover basic fundamentals of ceramics important to investment casters with emphasis on metal-mold interface reaction.

R. D. Sweigart and E. M. Baker, Corning Glass Works, Corning, N. Y., are in charge of arrangements for the course. Tuition will be about $100 plus room and board. Information on registration may be obtained from the ICI, 27 E. Monroe St., Chicago 3, Ill.



CARBON determinator NO 3003



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Four speakers at the conference were, left to right, Richard DeWalt, Lehigh Inc.; Walter Jaeschke, Whiting Corp.; R. Rosumny, Picker X-Ray Corp.; and W. Kenneth Bock, National Malleable & Steel Castings Co.

T and O Conference Held by

MALLEABLE FOUNDERS SOCIETY

By WILLIAM G. GUDE
Managing Editor
EDWIN BREMER
Metallurgical Editor
and
ROBERT H. HERRMANN
Associate Editor

● PROBLEMS connected with day-to-day foundry operations were the subject for discussion at the fifth annual Technical and Operating Conference of the Malleable Founders Society.

The conference, held at the Wade Park Manor, Cleveland, Feb. 17-18, included four sessions devoted to the general topics of communications, high-integrity castings, production tools, and research tools.

Better Communications; the Key to Improved Operations by Prof. Wesley Wiksell, Louisiana State University, was an effective explanation and demonstration of the inefficiency of much of the communication between individuals in industry and of how it can be improved.

The speaker listed the various factors which prevent the individual's communications or instructions from being understood or accepted, and also pointed out that the recipient's failure to listen properly contributes to the breakdown of the communication channels.

On this same subject, John T. Bryce, Albion Malleable Iron Co., Albion, Mich., emphasized the need for speaking at the level of the other man in a language he understands. Don't transmit non-intelligence, he warned.

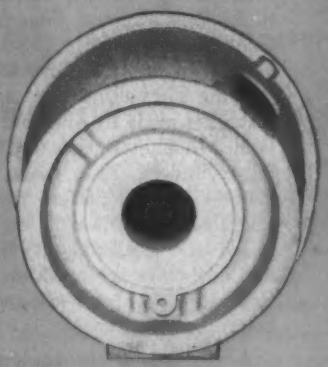
Effectiveness of the Malleable Founders Society's communications with its members was discussed by Lowell D. Ryan, executive vice president, and Hans J. Heine, technical director.

New Horizons in Casting Methods by Robert J. Ely, American Brake Shoe Co., Mahwah, N. J., described the production of high-integrity steel castings, primarily for aircraft and missiles. These parts, cast in ceramic molds, develop tensile strengths of 150,000 to 300,000 psi. Use of high-purity metal with ceramic molds is relatively expensive but the higher cost is reduced by a lower scrap rate from hot tears and cracks. (Production of these castings was described in FOUNDRY, November, 1959.)

High-property aluminum castings, featuring improved strength and ductility, also are produced by American Brake Shoe Co. (see FOUNDRY, January, 1959). Principal factors in the development of these properties are high-purity metal, hydrogen control, and adequate chilling, risering, and heat treatment.

Another Look at Molding Methods by Prof. Richard W. Heine, University of Wisconsin, was a most comprehensive analysis of various factors related to 13 different molding processes. These processes included green sand, dry sand, sodium-silicate, shell, air-set, investment, Mercast, ceramic shell,

PARASPRAY



Photograph of Large Casting Produced at Sonith Using Paraspray

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Other Paraspray Users Express Enthusiasm

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"On dry sand cores it improves the surface finish and helps reduce moisture in the mold and the possibility of loose sand."

From Gray Iron Manufacturer . . .

"With the use of Paraspray we have eliminated core cuts, have no penetration of iron into cores."

From a High Pressure Valve Producer . . .

"By using Paraspray we have been able to show a 50% smoother finish with a big saving in molding time. We get a clean hole, free from rat-tails and fins. It has never failed."

From an Aluminum Company . . .

"Paraspray's use has proven a great boon in increasing production as well as the quality of the castings for our air-cooled cylinder heads."

From a Nickel Bronze Castings Foundry . . .

"Paraspray is the best product that we have found to date for coating green sand molds for 20% nickel bronze castings. Due to its pouring temperature, Paraspray has eliminated any skin drying."

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Circle 636 on Page 53

Glass-Cast, Shaw, Unicast, expendable graphite, and semipermanent graphite mold.

In each case the molding method was discussed from the standpoints of type of pattern, mold material, method of molding, principle of bonding, mold bulk density, parting, dimensional accuracy, surface finish, alloys cast, and its adaptability to production of malleable castings. Importance of selecting the molding method best suited to the job was emphasized, since all processes are satisfactory when the particular casting design and specifications are suitable.

Refractories and molding techniques were considered at a session devoted to production tools. Richard DeWalt, Lehigh Foundries Co., Easton, Pa., discussed **Electric Furnace Refractories** and pointed out that present practices developed over a period of time have resulted in lower refractory costs. Furnaces are operated continuously from 6:30 a.m. Monday until 3:30 p.m. Saturday. Roof and sidewalls are formed of a refractory from Alabama which is blown into place with a pneumatic gun. Present roof life is 450 to 500 heats, and the sidewalls last 1450 to 1500 heats.

Advanced Molding Techniques—R. L. Page, Central Foundry Div., General Motors Corp., Defiance, O., described one of two fully automatic molding lines using cope and drag machines made by SPO Inc., Cleveland. Machines have 12-in.-diam jolt cylinders, 36-in.-diam squeeze cylinders, 12-in. pattern draw, and take flasks 32 x 43 x 11 in. Squeeze heads and sand hoppers move in and out above the machine platens. Production is about 190 molds per hour.

Advantages of the equipment include increased production and lower labor cost; longer pattern life; improved mold quality; less skill required by operators; less sand usage due to metering, and improved safety conditions. Disadvantages include less flexibility in job changes; greater capital investment, and greater loss of production when the machine is down.

Robert Levine, Central Foundry Div., General Motors Corp., Saginaw, Mich., talked briefly on an installation using blow and squeeze molding machines made by Osborn Mfg. Co., Cleveland. Machines produce cope and drag molds at the same time through use of two patterns on the machine platens. Flasks employed are 16 x 19 x 5 in., and production rate is around 225 molds per hour.

Advantages include consistent mold hardness on vertical and horizonal surfaces and reduction of noise because no jolting is used. Sand properties must be kept uniform to prevent difficulty from plugging of blowholes in the machine.

Robert Greenlee, Auto Specialties Mfg. Co., St. Joseph, Mich., speaking about similar equipment installed in his firm's foundry, indicated that average production on a weekly basis is approximately 300 molds per hour. Flasks used are 16 x 19 x 8 in. Even though the patterns receive heavy usage, wear is low, and molds are produced at a lower cost.

Refractories — The Overlooked Production Tool—Walter R. Jaeschke, Whiting Corp., Harvey, Ill.,

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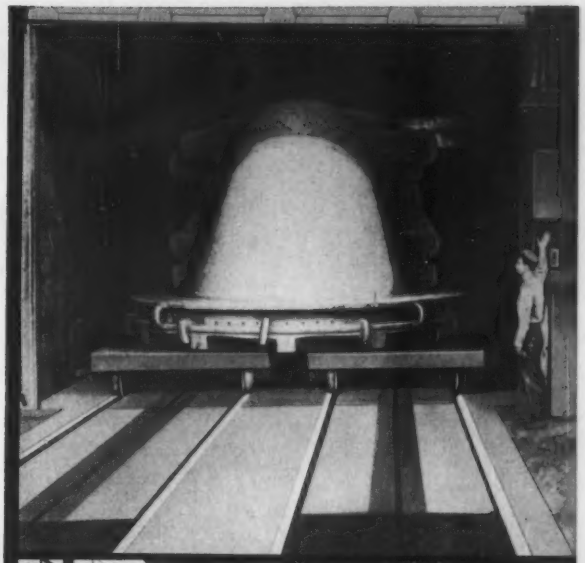
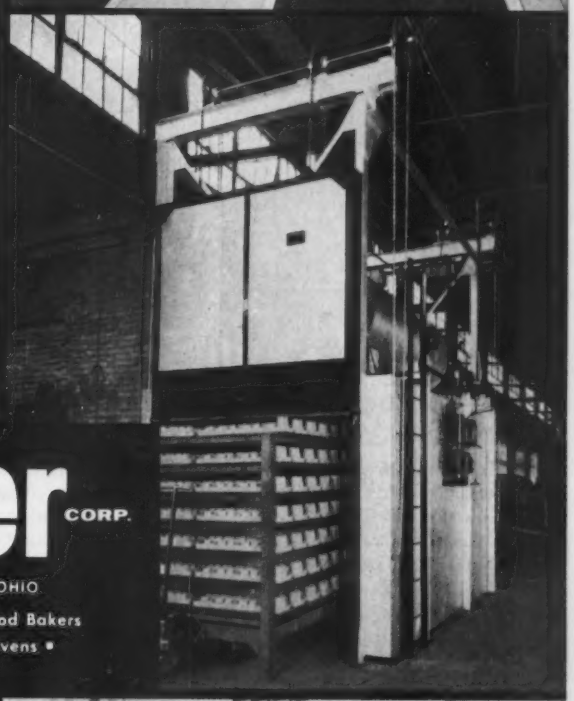
Carl Mayer designs and manufactures all types of ovens as well as "specials" to meet unusual operating conditions. Most incorporate the Carl Mayer recirculating heating system with sealed combustion chamber that keeps gases from prematurely escaping into the load area. Cores and molds are baked evenly with no burning. Temperatures are always under control.

Write for Bulletin 53-CM





TOP RIGHT—This large car type mold oven is installed at Pittsburgh Steel Foundry. Its special triple slotted panel construction reduces heat loss 1/3. Fuel savings up to 50% over old conventional methods are possible. Drying time is often cut in half and temperatures are uniformly controlled.

MIDDLE RIGHT—This rack type core baking oven is at the Fremont Foundry Co., Fremont, Ohio. It is equipped with a recirculating combination gas-oil fired heating system.

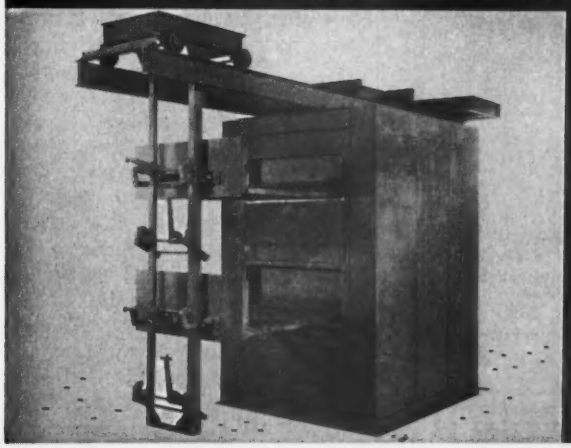
BOTTOM RIGHT—Vertical Core Oven (unloading position) at A. C. Williams Company, Ravenna, Ohio. This oven is 11'-0" wide x 11'-0" deep x 45'-0" high.

BELOW—Our standard rolling drawer type core baking oven. The heating equipment (not shown) may be mounted on floor beside unit or on the roof. Particularly adaptable to brass and aluminum foundries.

THE **carl mayer** CORP.

20800 CENTER RIDGE ROAD CLEVELAND 16, OHIO

OTHER PRODUCTS: Heat Treating Ovens and Furnaces • Rod Bakers • Welding Rod Ovens • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories



lasts *over twice* as long as other belts!

Handling hot shakeout sand demands a belt that is really rugged. That is why a 355 ft. length of 30" x 7 ply Super-Insulated Sahara* is used for this gruelling sand reclaiming operation at this tractor foundry.

This belting thrives on heat and abrasion that kill off other belts 2 to 5 times faster . . . does a better job at far less cost to you.

Its special INNERLOCKED* construction of heavy-duty hard silver duck, long-fiber asbestos insulation, and exclusive impregnating compounds will give you maximum resistance to temperatures up to 600 degrees. Let Imperial solve your foundry needs. Time to start—Now.

Phone or write for complete information on how Imperial's Super-Insulated Sahara* can serve you better . . . cost you less.

**Registered trademarks of Imperial Belting Co.*

You expect MORE from Imperial . . . and you get MORE!

Imperial INNERLOCKED® BELTING

First in stitched canvas belting for over 50 years

MAIL FOR HELPFUL DATA

Imperial Belting Co.
1760 S. Kilbourn Ave., Chicago 23, Ill.

( ) I'd like a free belting survey of my plant

( ) Please send your catalog and engineering handbook.

Name_____

Company_____

Address_____

indicated that fire clay refractories are most common in the malleable field. Different types have a wide range of softening temperatures. In general, the firebrick should be uniform in size, have low deformation at the operating temperature so that they hold their shape, have low spalling characteristics, and possess low porosity to keep penetration at the minimum.

Mortar used in laying the brick in furnace construction should be of the same or better quality than the brick. Also, allowance for expansion of brick under operating temperature must be included to prevent "pinching" or squeezing out.

Six topics were discussed under the general title of **Research Tools Useful To Production** at the concluding session. The first was by C. M. Eberhardt, Central Foundry Div., General Motors Corp., Danville, Ill. He described use of a neutron source for controlling moisture content of molding sand.

The source, mounted in a proper holder, is placed in a 3200-lb batch of sand. Detectors are placed outside the sand. Because moisture in the sand affects the flow of neutrons to detectors, the amount of moisture can be determined and adjusted.

William H. Martin, Applied Research Laboratories, Pittsburgh, described a direct-reading vacuum chamber quantometer for determining up to 24 elements simultaneously in 1½ minutes. The iron sample is placed in an argon atmosphere spark chamber, and the lines of energy pass through a lens to the vacuum chamber to be sorted by the machine. Each line of energy indicates the percentage of an element contained in iron.

Ultrasonic inspection methods were covered by Ralph H. Frank, Sperry Products Inc., Danbury, Conn. These methods employ high-frequency vibrations directed through the sample. Measurement of vibration energy levels and of the time for echoes to reach the surface of the part provides data on flaws in castings. Ultrasonic inspection can be used to detect, locate, and measure the size of flaws; to measure thickness of the part; to study metallurgical structure, and to determine modulus of elasticity.

Mark R. Rosumny, Picker X-ray, Corp., Cleveland, discussed radio-

Circle 639 on Page 53

In Milwaukee, The Vilter Manufacturing Company uses . . .

3/4 inch of
BERLITE
to line 2600 lb. ladles

BERLITE-lined 2600 pound ladle

IRONTON BERLITE

is "insurance" for the Vilter foundry where VILTRITE castings have to be right the FIRST TIME. The superintendent there specifies BERLITE for lining ladles because his long experience shows consistently...absolutely

- NO EROSION
- FORMS NO SLAG
- NO METAL STICKS TO BERLITE LINING

(any shell that forms in ladle is easily knocked out without harm to the lining)

All the facts on this BERLITE application are available from Ironton. If you want to test Ironton BERLITE in a ladle, let us know. We will show you what a RELIABLE REFRACTORY can do!

SINCE 1917 THE IRONTON FIRE BRICK COMPANY IRONTON, OHIO

1329 Ashtabula Street

Write or call Ironton collect for name of nearest representative.

graphic techniques with radioactive isotopes, primarily cobalt 60. Sensitivity depends greatly on the proper relationship between source size and distance of source from the film. Most fuzziness in a radiograph is due to scatter of the radiation in the specimen. Scatter can be reduced by restricting the beam to the area of film.

In a discussion of statistics, Dr. W. Kenneth Bock, National Malleable & Steel Castings Co., Cleveland, listed the following statistical tools for foundry experiments: Regression analysis—determines effect of one factor such as an additive to a metal and shows if resulting trend line is real or accidental. Analysis of variance—shows data scatter between certain limits and determines reasons for the scatter. Factorial experiment—determines factors which affect a project or process and provides a means of determining interactions. Operations research—shows how to operate a business to achieve a specific goal.

Hans J. Heine, MFS technical director, gave a progress report on research work being done in producing malleable iron castings by the Parlanti mold process. The process involves the use of anodized aluminum molds.

Preliminary research findings indicate that malleable castings produced in the molds have tight grain structure, small crystal size, and compact graphite nodules with a high nucleus count per unit area. Brinell hardness is high and, at

GIFT OF BOOKS: Dr. E. Brooks Earnest, right, president, Fenn College, Cleveland, receives part of a gift of books on foundry operations from James J. Schwalm, Archer-Daniels-Midland Co., on behalf of the Northeastern Ohio Chapter of AFS.

At Adell Foundry Co. in Wisconsin, Supt. Bintzler gets

6 months service from
"SPLITS and BERLITE"
ladle lining

Mr. Bintzler (hand on wheel) and helper with BERLITE-lined ladle.

EASY WORKING, EASY CLEANING

that's what foundrymen want in a lining for grey iron ladles. At Adell, they say nothing ever tried can equal

IRONTON BERLITE

The "Bintzler Sandwich" of BERLITE and brick may be the lining you need. All the details are in a service report that Ironton will send without obligation. Try BERLITE and see why so many foundrymen say it's the only lining they will use for bull and pouring ladles.

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1329 Ashtabula St.

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Circle 640 on Page 53

Circle 641 on Page 53

CHOOSE YOUR WEAPON

for WAR against the SCRAP PILE!

Guessing when to pour, or using inaccurate temperature measuring instruments, results in misruns, cold-shuts or leaving molds on the floor unpoured. Equip your foundry with dependable Marshall Enclosed-Tip Thermocouples for strong, dense, uniform castings from every melt!

MARSHALL THERMOCOUPLES OFFER THESE ADVANTAGES!

DEEP READING. Takes interior temperature deep within melt . . . tip can be immersed 3 inches or more in depth!

FAST RESULTS. Tip can be stirred to speed reading, giving true temperature in about 20 seconds!

ACCURACY. Pyrometer always indicates steady, accurate reading!

ECONOMY. Hot junction tip, armored with enclosing tube of special alloy, withstands scores of immersions before replacement is necessary!

FLEXIBILITY. Well-balanced thermocouple is convenient to carry and use, simple to operate!

TROUBLE-FREE. Has ruggedly designed parts for long-life reliability. Thermocouple wire can't be contaminated from melt or shortcircuited by slag!

CHOICE OF TYPES. Furnace Type (below, right) . . . lengths up to 10 feet for use with Stationary Pyrometer. Ladle Type (below, left) for use with Portable Pyrometer.

Write today for FREE catalog!

L. H. MARSHALL CO.
270 WEST LANE AVE., COLUMBUS 2, OHIO

comparable tensile strength values, average elongation is higher for the Parlanti mold cast test bars.

Malleable Founders Conference Looks at Marketing Problems

"Markets and Marketing in the Soaring Sixties" is the theme of the 11th Market Development Conference to be held April 13-14 at the Edgewater Beach Hotel, Chicago. The conference is sponsored by the Malleable Founders Society.

Speakers for the conference are expected to take a long-range look at markets for malleable products. They include Thomas H. Spencer, quality control manager, Caterpillar Tractor Co.; James M. Bourke, vice president, First National Bank of Chicago; Stephen G. Harwood, president, Canadian Car Co.; and Edward M. Walther, senior partner, Management Development Associates. Ample time has been provided for discussion of marketing problems.

For more information and for reservations, write to the Malleable Founders Society, 781 Union Commerce Bldg., Cleveland 14, Ohio.

NW Pennsylvania Chapter Plans Symposium on Defects

A symposium on casting defects will be held April 11 and 12, from 7:30 to 10 p.m. each evening, at the Memorial Jr. High School, 3325 Cherry St., Erie, Pa. Sponsor is the education committee of Northwestern Pennsylvania Chapter, AFS.

Different material will be covered each evening, and the discussion will include analyses of defects in all types of cast metals. A panel will identify the defect, give possible causes, and suggest solutions.

The panel consists of the following: Ray Cochran, R. Lavin & Sons, Chicago; Donald L. LaVelle, American Smelting & Refining Co., New York; David Matter, Ohio Ferro-Alloys Corp., Canton, Ohio; Clyde A. Sanders, American Colloid Co., Skokie, Ill.; and Ralph White, International Nickel Co., New York.

Reservations are available at the door. The $5 fee for the entire program includes a copy of the AFS *Handbook on Casting Defects.*

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Circle 643 on Page 53→

The alternate to this is . . . DOWNTIME!

An ounce of prevention . . . can eliminate *downtime* in your plant. With today's highly mechanized manufacturing and distribution methods . . . *downtime* of materials handling equipment can mean the difference between a profit or a loss.

A Clark Dealer *Continuous* Maintenance Program, available from 113 Clark dealers across the continent, offers you the most effective, and economical method of reducing costly *downtime*. Here's why!

In brief, a Clark Dealer Continuous Maintenance Program offers you:

1) . . . regular maintenance on your industrial trucks on a *programmed* basis. Scheduling is conveniently set up for your particular operation. If you like, service to your equipment can be done at night or at any other time when your equipment is not in use. The additional cost for this off-shift service is a small percentage of the cost of *downtime*.

2) Clark dealers, with the aid of a national service personnel training program, assure you that the best trained mechanics in the industry will service your equipment. These highly trained specialists perform a minimum of 22 separate inspections on every truck serviced. They not only perform the normal jobs of greasing and oil changes, but also make all necessary adjustments to your equipment. Most important, they report the condition of your machines, anticipating failure before it happens. As a result . . . *downtime* is drastically reduced.

3) A Clark Dealer Continuous Maintenance Program gets you out of the repair and maintenance business. It eliminates the need for special tools, parts stock and use of valuable plant space for servicing facilities.

4) A Clark Dealer Continuous Maintenance Program is economical. It actually costs less than similar service on your own automobile. This is an inadequate comparison, however, when you consider the small cost of preventive type maintenance to the cost of *downtime*.

For detailed information on a Clark C.M. program call your local Clark dealer (he's listed in the Yellow pages) or write: C.M. Service, Clark Equipment Company, Battle Creek, Michigan. No obligation, of course.

CLARK® EQUIPMENT

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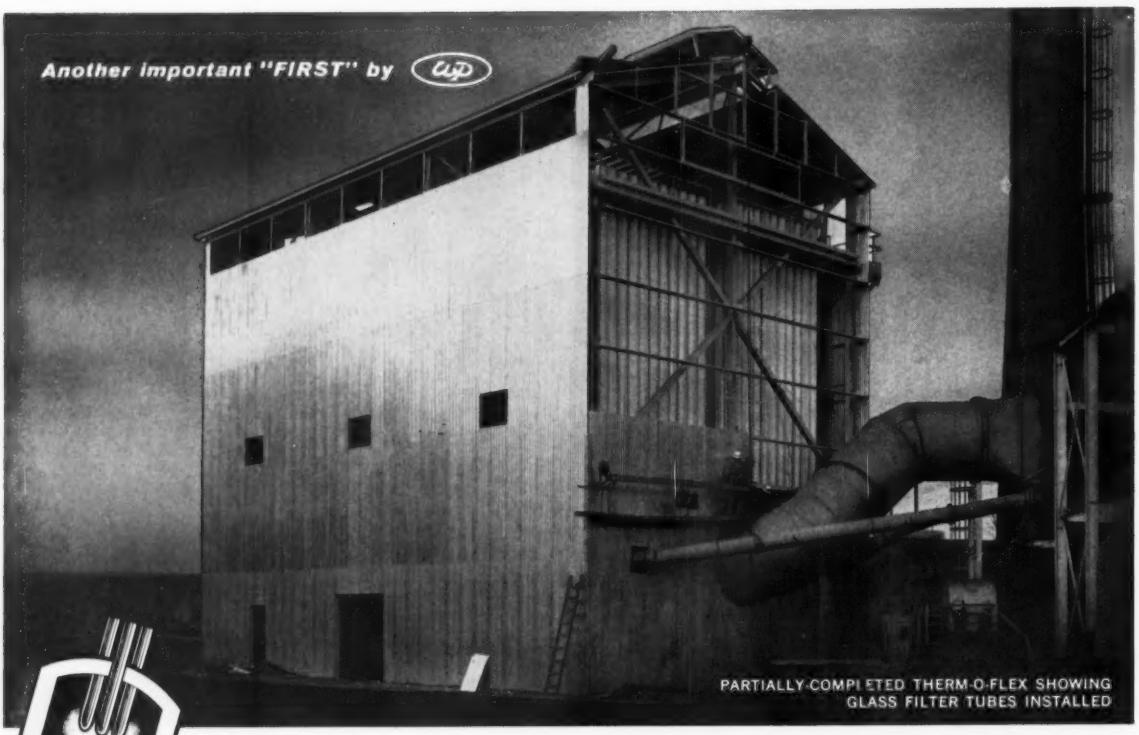


PARTIALLY-COMPLETED THERM-O-FLEX SHOWING GLASS FILTER TUBES INSTALLED

To Clean Electric Furnace Fumes To 550° F.

A MAJOR STEEL COMPANY

SELECTS THERM-O-FLEX GLASS FILTERS!

SELECTION MADE AFTER EXTENSIVE PILOT PLANT STUDIES PROVED "THERM-O-FLEX" ADVANTAGES

To insure clean gas emission from its large electric furnace operations, a major steel company has installed a Western Precipitation "Therm-O-Flex" Hi-Temperature Filter system *—the filter system featuring silicone-treated glass bags that efficiently clean gases as hot as 550° F!*

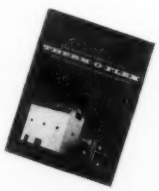
This is one of the first steel plant installations to use glass bag filters for cleaning electric furnace emissions, the installation being made only after an exhaustive pilot plant study. Subsequent operation of the full size installation has clearly substantiated the pilot plant results and has demonstrated the unusually high collection efficiency of "Therm-O-Flex" equipment on this type of application.

No Shaking Required

In addition to their ability to handle unusually hot gases, the specially-treated woven glass filters of the "Therm-O-Flex" permit the filter units to be easily cleaned by simply collapsing the bags. *No destructive shaking processes are required.*

Furthermore, the large diameter filter tubes (12″ in diameter) provide more efficient cleaning of the collected material on each collapsing cycle—another operating advantage engineered into each "Therm-O-Flex" installation by Western Precipitation dust control "know-how."

"Therm-O-Flex" is one of six types of gas cleaning equipment offered by Western Precipitation — "Cottrell" Electrostatic Precipitators, "Multiclone" Centrifugal Collectors, "CMP" Combination Multiclone-Precipitator units, "Therm-O-Flex" Hi-Temp Filters, "Dualaire" Jet-Cleaned Filters, and "Turbulaire-Doyle" Scrubbers. No other organization provides such wide range dust collection experience — no other offers such unbiased recommendations to fit the requirements of your particular operations. You simplify your gas-cleaning problems by bringing them to Western Precipitation.



Send for "Therm-O-Flex" Bulletin #F105R

Only WP has All 6

1. COTTRELL Electrical Precipitators
2. MULTICLONE Mechanical Collectors
3. CMP Combination Units
4. DUALAIRE Jet-Cleaned Filters
5. THERM-O-FLEX Hi-Temp Filters
6. TURBULAIRE-DOYLE Scrubbers

Also: HOLO-FLITE Processors
HI-TURBIANT Heaters

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DIVISION OF JOY MANUFACTURING COMPANY T 125R

Engineers and Constructors of Equipment for Collection of Suspended Material from Gases . . . and Equipment for the Process Industries

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Precipitation Company of Canada Ltd., 8285 Mountain Sights Avenue, Montreal 9

Walter L. Seelbach . . .

50 YEARS IN THE FOUNDRY INDUSTRY

● WHEN YOU WANT a job done well, get the busiest man you can find to do it. For many years the foundry industry has confirmed this truism by calling on Walter L. Seelbach, of Cleveland when a tough job has needed doing.

As a result, few men have served this industry so long and in so many ways, or have given so much of themselves to advance it—frequently, competently, unselfishly. For 50 years Walter Seelbach has been "on call" with unstinting energy.

How It Started—It all started with his study of civil engineering at Case School of Applied Science (now Case Institute of Technology) in Cleveland. On leaving Case, he went to work as a timekeeper for Walworth Run Foundries, served as assistant manager and secretary-treasurer, and continued in those posts when Walworth merged with Forest City Foundries. In 1946, he acquired Superior Foundry Inc., which now also includes Allyne-Ryan Foundry Co., and Mr. Seelbach continues as president and board chairman of his company.

Since the early twenties, Walter Seelbach has served the foundry industry almost continuously in some extracurricular capacity. President of the old Ohio Foundrymen's Association (predecessor of the AFS Northeastern Ohio Chapter) in 1926, he was a prime mover in organizing the former Gray Iron Institute. Walter was elected first president of the Gray Iron Institute in 1928. Later, after the institute became the Gray Iron Founders' Society, he again served as president in 1943-44, and is the only man to be called back to that important office. In all, he served as a director of the society for 13 years. He also has served as treasurer, chairman of the budget and finance and citations and awards committees, and as a member of the executive and program evaluation committees.

An honorary life member of AFS, he received the Gray Iron Founders' Society's Citation in 1946 and its Gold Medal award in 1951.

Long Service to AFS—In 1935 Walter Seelbach was elected a director of the American Foundrymen's Society for three years, became vice president in 1950, served as AFS president in 1951-52, and presided at the International Foundry Congress in Atlantic City in 1952. He has been an AFS official delegate at three International Congresses held in Europe.

During World War II and the Korean conflict, he was active in representing the industry in government bodies—on the industry's Advisory Committee to the Office of Price Administration; the Gray Iron Advisory Committee to the National Production Authority; chairman of the Foundry Industry Subcommittee on Gray Iron to the Munitions Board; an industry member of the 5th Regional War Labor Board and the Wage Stabilization Board. Earlier, he was chairman of the Gray Iron Industry Steering Committee to NRA.

Long active in community fund drives and civic affairs in Cleveland, Walter Seelbach is past president of the Associated Industries of Cleveland and was vice president of the city's Better Business Bureau. In 1947 he was named to Cleveland's Hall of Fame. He is past chairman of the Case Institute Industry Committee for the Foundry Educational Foundation, of which he long has been an active supporter.

The business record is impressive, and Walter has long set high standards of integrity and unselfishness. In his personal record, he has a legion of staunch friends because of his patience, understanding, and willingness to lend a helping hand.

What honors his beloved foundry industry now gives him for 50 years of service rounds out nicely the success, the experiences, and the fun he has had as a man the industry is proud to call "A Foundryman of Distinction."

Honored at Dinner—Mr. Seelbach was recognized and honored at the AFS Northeastern Ohio Chapter dinner meeting in Cleveland on March 10, which was designated "Walter Seelbach Night." Honors were bestowed jointly by officials of both AFS and GIFS, many of whom came from the East and Midwest to be present. Feature of the evening was the presentation by both AFS and GIFS of bound volumes of letters from his friends which paid tribute to Mr. Seelbach for his 50 years of untiring service to the foundry industry. The chapter presented a certificate.

Man to Man

By RALPH L. LEE, *President*

Lee Hobby Foundry
Birmingham, Mich.

"The progress of an organization is due substantially to all of the tiny bits of contributions made anonymously by many ordinary folks"

The Source of Suggestions

● I IMAGINE that it would be pretty hard to find anyone in industry nowadays who isn't familiar with or has not taken part in organized efforts to pry the rank-and-file employee loose from constructive ideas he might have bouncing around in his head.

As we all know, there are suggestion contests galore and a National Association of Professional Suggestion System Suggesters and Technicians. "Brain storming" sessions, in which employees are quizzed for answers to questions, in a friendly and respectful atmosphere have become commonplace.

Suggestion Plans Pay—From what I see, hear, and read, going around the country, statistics are piling up which indicate that this nationwide movement to extract good ideas from every conceivable source is paying off to a point where the books definitely are in the black—or, let us say, show a dark pink. There seems to be no question that the activity is here to stay.

Some 48 years ago, I was a member of a large group of National Cash Register Co. employees who, at a banquet complete with pep and appreciation speeches plus beautiful music, received prizes for winning in a suggestion contest. My prize was a $20 gold piece in a chamois bag, together with a beautifully engraved certificate and my picture in the company paper. I was third from the left in the fourth row back, with just my head showing.

Encouraged by this honor and money, I put on full steam in an effort to cook up more prize winners, but for some reason or other my new suggestions didn't click. In spite of the well worded form letters notifying me of the rejections and including admonitions to keep the old chin up, never say die, and try, try again, I lost interest in the activity.

In the light of all the water that has gone over the dam since, I guess one of the reasons that I gave up trying to win more prizes was that I had no way of knowing what the normal batting average of suggestions made to suggestions accepted was. I did not know that 1 out of 100 is exceptionally high in many well organized creative groups devoted exclusively to getting and developing ideas.

How to squelch an idea

Making a Plan Work—But of one thing I feel quite sure: The way employee suggestions are rejected has a greater bearing on the possible success of an organized activity than the value of the prizes—that is, if participation is to be considered a measure of its success along with the value of the suggestions produced.

I've got to be careful of how I put this, but sometimes I wonder whether the launching of a crash program for the encouragement of employee suggestions might not indicate that the normal resistance in the day-to-day suggestion circuit between employee, foreman, superintendent, and the top front might not be entirely too high to get any juice through, and there might be some fuses out.

One of the surest ways to kill the suggestion crop it seems to me, is to make snap judgments of an idea on the basis of who has it rather than on what it is. We might be amazed at the number of product or process improvements now in effect which really were sparked by some none too brilliant comment made by some seemingly unquali-

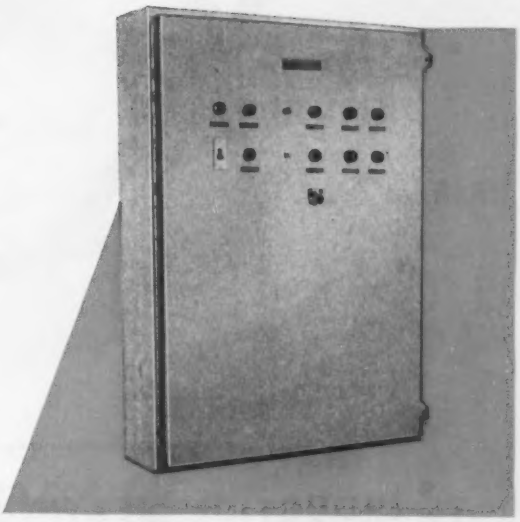
HARTLEY ▸ *the FIRST* *the FOREMOST* *the FINEST*

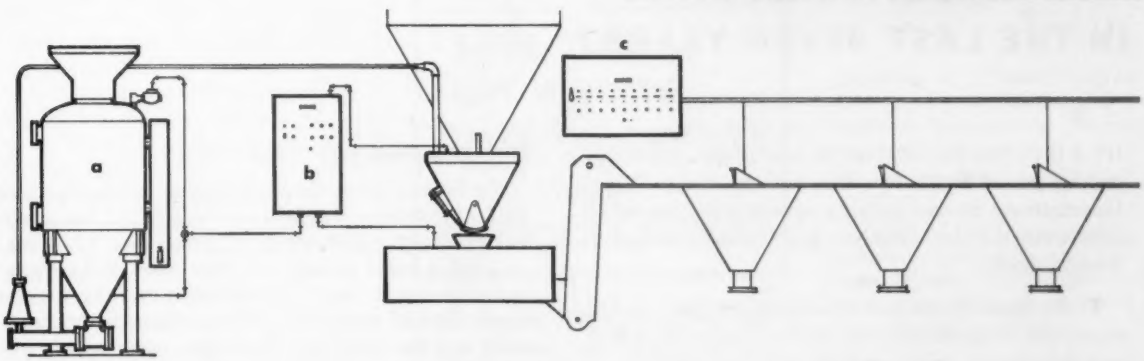
Hartley Sand Controller, Series XII, operates all — or any combination of:

Moisture Controls • Mixer Timers • Bond Feeders • Bin Controls • Mixer Selectors • Pneumatic Transporters

. . . *in complete Foundry Sand Automation*

● A single Hartley control cabinet *delivers* the precision impulses that remove guesswork, loss of time and lack of uniformity in foundry sand systems. From transporting raw sand to the control of moisture, bond additions and cycling in the sand reconditioning process, there is no waiting, no waste, no wondering. What's more, it is not necessary to automate your complete operation at once. Hartley equipment can be added and interlocked in stages. Let the savings from one unit pay for another until your sand system is fully automated.





Line drawing shows a typical Hartley installation:
(a) Bond Feeder, (b) Series XII Sand Controller, (c) Sand Level Control.

Complete specifications and recommendations concerning special problems will be sent promptly.

HARTLEY *Controls* CORPORATION • NEENAH • WISCONSIN

Circle 645 on Page 53

WHAT'S HAPPENED TO INDUCTION MELTING IN THE LAST SEVEN YEARS?

It's a little like the old days all over again! Induction melting passed twenty-five years without change. Then Inductotherm decided to bring induction melting up to date. Since that day, seven years ago, there've been some changes made.

To the basic advantages of induction melting—speed, cleanliness, magnetic stirring—Inductotherm has added easy installation, easy operation, and easy care.

For example, Inducto® initiated power feed through the trunions in their tilting furnaces—thus reducing lead length, cutting power loss, simplifying pit construction. Small furnace design is also ingenious. Even the smallest hand held furnaces have "plug-in" mercury type fittings for fast and effective power disconnect during a pour.

Why do business with Inductotherm?

The biggest innovation in induction melting has been the Inductotherm concept of service. Not just fast repairs and overnight replacement of parts (even M-G sets) . . . but a basic concept of "why we're in business." *Inductotherm is out to fit induction melting to your needs.* We will make every effort to improve our equipment and the induction technique, never asking you to trim your needs to the limitations of our equipment.

If you'd like more information on Inductotherm furnaces, write for Bulletin 70. But, for a taste of Inductotherm service, ask to have an engineer call. Inductotherm Corporation, 412 Illinois Ave., Delanco, New Jersey.

INDUCTOTHERM

fied individual whose identity was lost sight of in the early stages. Ideas might be like babies—you sometimes don't know what they might grow up into.

Glory grabbers certainly can play hob with a free flow of suggestions and with the entire man-to-man relationship of a department or organization. But possibly the deadliest squelcher of a widespread idea-breeding epidemic is the habit of blasting off about all that's wrong at any one who dares to stick his neck out with a hunch or idea. Even worse is laughing at people, even before they're through telling what they have in mind, and between guffaws hinting that they'd do better tending to their own knitting. All this sounds almost infantile, but by heck it does go on—in some places, that is.

The Positive Approach—Several weeks ago, in a talk before the national meeting of the Society of Statistical Quality Control Engineers, I suggested an experiment that might be interesting for them to try: "After you have gathered all of your data, slipsticked it into curves and such, and come through with irrefutable proof as to what truly is rotten in Denmark, bite your tongues and throw your gears into reverse. Present your findings by pointing out the commendable things your studies revealed and suggest that if the bosses cared to, at a later date they could subtract these commendable things from the total involved so as to arrive at the things needing attention."

I commented that my mathematics were sound since it makes no difference whether the positive is subtracted from the total to get the negative or vice versa, but it makes a whale of a difference from the standpoint of human relationships.

I always have felt that the progress of an organization, in spite of outstanding streaks of individual genius, and with all due credit to the likes of them, is due substantially to the accumulated tiny bits of contributions made anonymously by a great many common, ordinary folks.

It might not be a bad idea for us to check the resistance of the suggestion circuit between employee, his foreman, his superintendent, and what-have-you into the innermost control board.

STEP UP YOUR PRODUCTION OF SHELL CORES AND MOLDS WITH . . .

FASKURE

RESIN COATED SAND

THE FASTEST CURING SAND AVAILABLE

REDUCE YOUR COSTS

- SAVE TIME
- CUT REJECTS
- IMPROVE QUALITY

FREE TECHNICAL SERVICE

Ask for demonstration

CONTACT US DIRECT, OR THE FOUNDRY SUPPLY DEALER NEAREST YOU!

Foundry Supply Co., Minneapolis, Minn.

Brandt Equipment & Supply Co., Houston, Texas

St. Louis Coke & Foundry Supply Co., St. Louis, Mo.

Fischer Supply Co., Chattanooga, Tenn.

Fredric B. Stevens, Inc., Detroit, Buffalo, Cleveland, Chicago, Indianapolis, Milwaukee, New Haven, Springfield (Ohio)

FASKURE is a tested, proven product — a combination of our exclusive formulae and processing, backed by years of experience in our own and many other foundries.

QUALITY CONTROL — positive uniformity assured by testing all sand to meet specifications for melt point, tensile strength and rate of shell formation.

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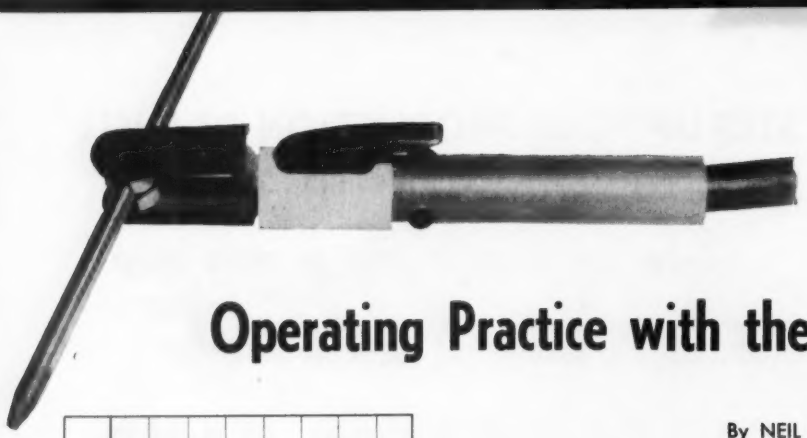


Fig. 1 — Torch with concentric cable and electrode in place

Operating Practice with the Arcair Torch

By NEIL J. KRUMM
Arcair Co., Bremerton, Wash.

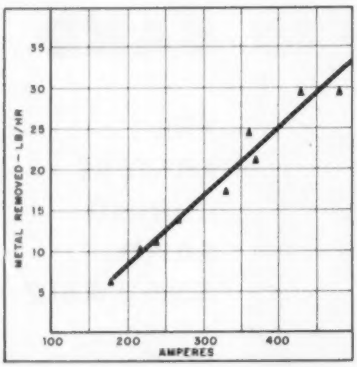


Fig. 2—Graph shows correlation of efficiency to current density

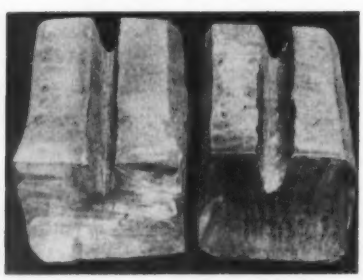


Fig. 3 — These blocks illustrate speed and cost of the process

Fig. 4 and 5—Steps in removing risers and riser pads from a ductile iron casting. Above, the raw casting and below, the finished job, done in 12 minutes

● ESSENTIALLY, the Arcair process is the melting of metal with an electric arc and simultaneous removal of the molten metal with a high-velocity air jet parallel to the electrode. Because the process is not dependent on oxidation, it works on metals which do not oxidize readily.

Equipment—The equipment consists of a torch with a concentric cable which carries both air and current and a copper-plated electrode of carbon and graphite. Fig. 1 shows a foundry torch with concentric cable and electrode in place.

An air line from an ordinary compressor or the shop air line is connected to the fitting, and the cable from a welding machine is attached to the lug. A button in the torch handle controls air flow. The electrode is held in a positionable head so that it can be set at any angle, but always directs the air stream at the work.

The electrode usually is a combination of carbon and graphite. These materials have different qualities, but a combination achieved by proper blending provides the properties required. Copper plating of the electrodes enables them to carry higher currents and maintain their original diameter (so that groove width is more uniform than it would be if the diameter decreased). Plating also increases operator comfort

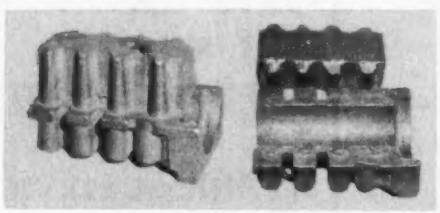
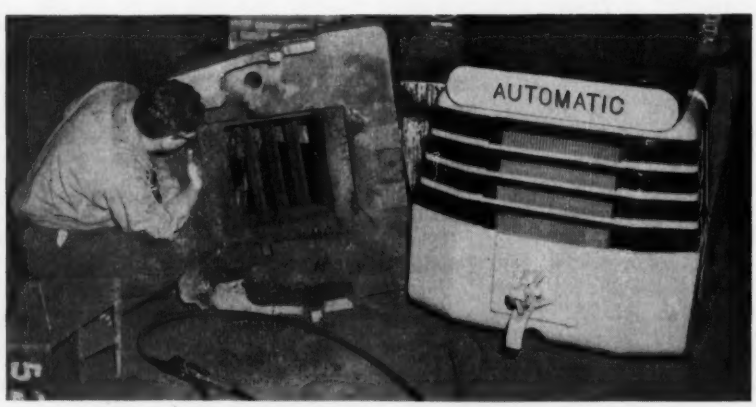


Fig. 6 and 7—A ductile iron casting is conditioned in preparation for machining. Heavy riser had to be removed without any damage to the bearing face

Fig. 8—On 4000-lb castings, four sections, about 4 in. thick, 3 in. wide, and 30 in. long had to be removed in a grill opening area



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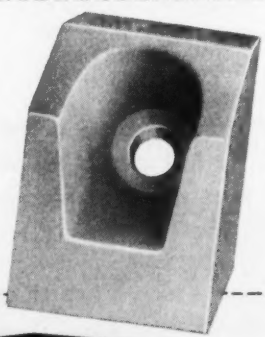

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Fig. 9—Removal of a defect from a large steel casting. The procedure employed is identical to that of washing riser pads in steel foundries

and prolongs the life of the torch.

Ordinarily, a direct-current machine with reverse polarity is used. With alternating current electrodes, which are preferable for cast iron and for metals with high nickel or copper contents, either direct current straight polarity or alternating current machines are used. The current setting depends on the size of the electrode and varies from 80 amp with the smallest (5/32-in.) electrode to 1600 amp with a ¾-in. electrode, the largest size being used with the process. The higher the current density, the more efficient the process becomes, as shown in Fig. 2, which was made up for ⅜-in. electrodes.

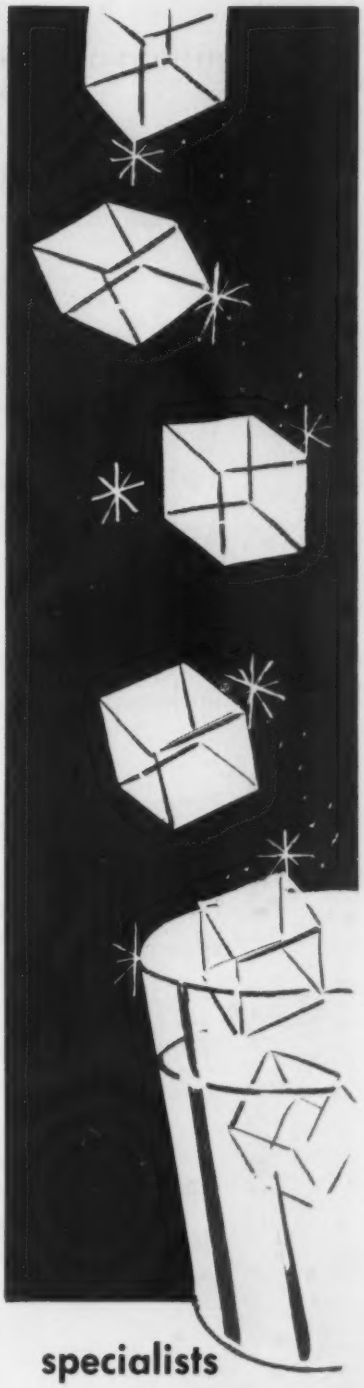
Compressed air is used to remove metal as it is melted. Gases normally should not be used, but when they are, they must be inert. Oxygen never should be used because it supports combustion. The torch is designed to operate at 80 to 100 psi, which is normal line pressure in most shops. Since this factor is not critical, no regulator is needed. To insure a proper air supply, no fittings or lines leading to the torch should have openings smaller than ¼ in. in diam. Otherwise, even though the pressure is high enough, the volume can be so low as to cause poor torch operation.

Operation—The torch is used by holding the electrode at a leading angle and striking an arc between the electrode and the material to be cut, directing the air blast immediately behind the point of arcing and moving the torch forward at a rapid rate with the air jet on continuously. The depth of groove is determined by the angle of the electrode and the speed of travel, which are controlled easily by the operator.

Quality of Cut—Cuts of nearly machine quality sometimes can be produced. A minute amount of carbon pickup occurs, but is confined to a zone about 0.006 in. thick. Since weld penetration exceeds this depth, welding dissipates all but a negligible amount of the carbon. In most work, this amount is not detrimental, but if complete removal is considered necessary, a slight amount of grinding before welding completely removes the condition.

Heat Conditions — Because the small area of metal being cut is brought to a molten state instantly, and because speed of travel is rapid, surrounding metal does not reach a high temperature. There is little possibility of distortion or crack propagation during the operation.

To show how the process holds down rises in temperature, a groove was cut in a 6-in. round steel plate,



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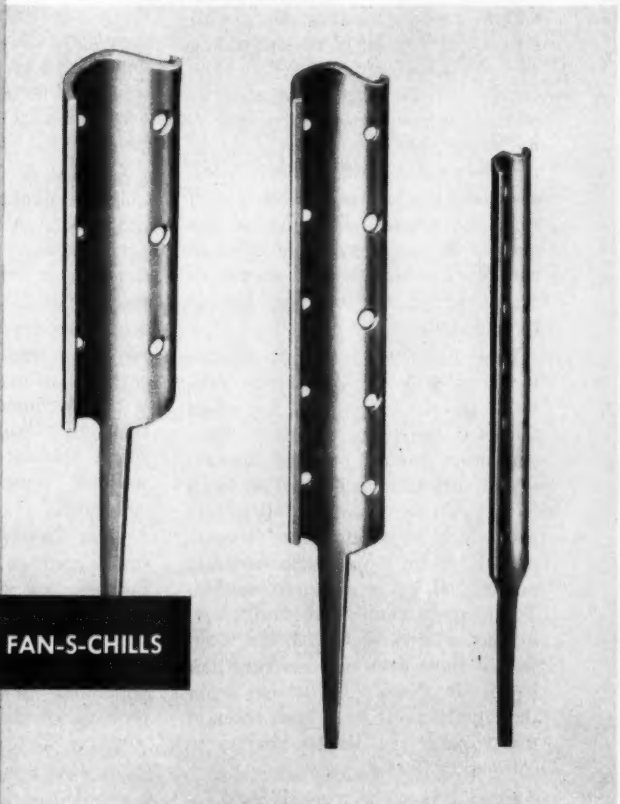

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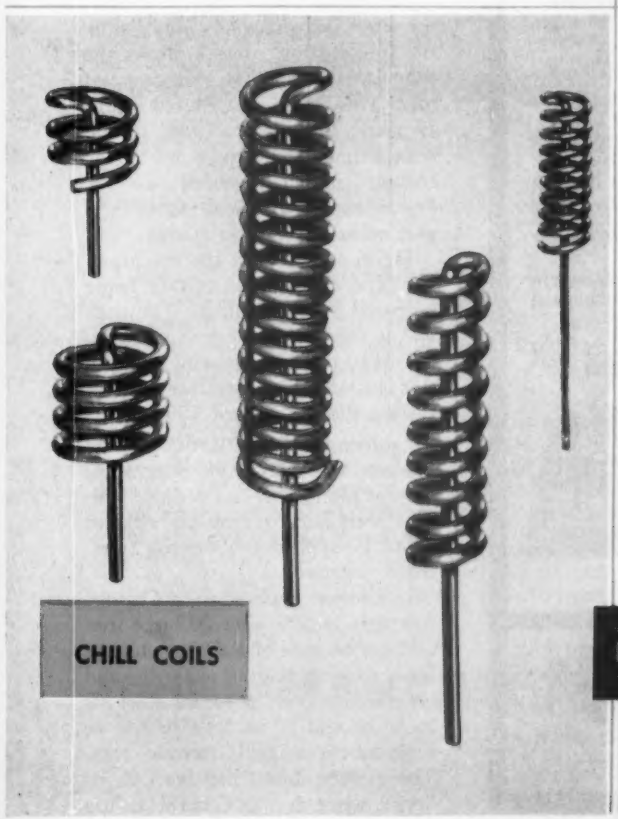

Circle 650 on Page 53

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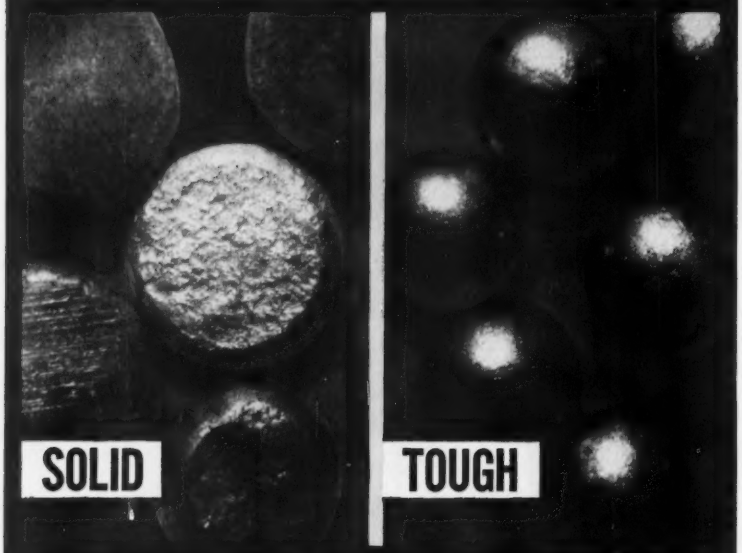

Rotoblast Steel Shot has already stacked up an impressive record of reduced costs in foundries* and blast cleaning departments* from coast to coast!

- Atlantic Coast steel foundry—Compared with premium abrasive formerly used, Rotoblast Steel Shot cuts abrasive costs *in half*—and gives better cleaning than before!
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- Large automotive foundry — Rotoblast Shot consumption 30% less than other steel shot tested; cleans castings faster!
- Eastern steel plant—Now uses Rotoblast Shot to descale steel strip, after exacting lab tests proved it better than previous steel abrasives!
- Midwest forge shop—Found Rotoblast Shot reduced abrasive costs 23% below that of abrasives previously used!
- Steel tank company—Cut cleaning costs in half (from 4c to 2c per sq. ft.) when it switched to Rotoblast Steel Shot.

These examples are just some of the many proving Rotoblast's cost-cutting qualities! Arrange a trial in your plant! Talk to your Pangborn man or write PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Maryland. *Manufacturers of Blast Cleaning and Dust Control Equipment—Rotoblast Steel Shot and Grit.*

*Names available on request

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¾ in. thick, with a pyrometer attached to the back surface. After 1 minute of gouging, the plate heated to only 250° F. After 2 minutes, the temperature was only 450° F. Heat input per pass is about 150 degrees F.

Speed and Cost—Speed of operation varies somewhat with individual shop conditions such as operator technique and current used. A groove ⅜ in. wide and ¼ in. deep can be cut at speeds up to 3 fpm, or just about as fast as the operator can move.

Speed and cost of the process are illustrated by the two blocks of 0.20 C steel grooved as shown in Fig. 3. The groove on the right was made with an arc-air process torch in 26 minutes. The one on the left was chipped in 1 hour 45 minutes, and four chisels required sharpening. On hard materials and those which harden, the time difference is much greater.

The actual cost of operation for the torch with ⅜-in. electrodes is about $1.50 per hour, exclusive of labor.

Removing Risers and Pads

Fig. 4 and 5 show steps in removing risers and riser pads from a ductile iron casting. Fig. 4 shows the raw casting, and Fig. 5 the finished job. This operation required slightly more than 12 minutes, during which time the temperature of the casting never exceeded 250° F. Specifications required a 275° F maximum.

Fig. 6 and 7 show the conditioning of a ductile iron casting being prepared for machining. The trick was to remove the heavy riser without damage to the bearing face. In this instance, temperature of the casting did not exceed 150° F.

Cutting on these two ductile iron castings was done with alternating current electrodes, and a direct current welding machine on straight polarity supplied the current (electrode negative).

In another application, a Chicago company had to alter 20 large iron castings because of a design change. Each casting weighed 4000 lb, and four sections, about 4 in. thick, 3 in. wide, and 30 in. long had to be removed in a grill opening area. The project almost had been abandoned when it was decided to use

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Five lines of Nomad Single Track Conveyor carry 50″ x 66″ molds weighing approximately 4000 lbs. The molds ride on wheeled pallets over heavy-duty steel rails (¾″ x 3″) set 10″ above floor level. A transfer car distributes molds for storage and pouring to the five lines.

STURDY CONSTRUCTION

This 52″ x 80″ pallet is shown on track before the mold has been placed on it. It is fabricated of heavy steel sections equipped with Nomad No. 1200 Rollers — each roller having a load capacity of 1000 lbs.

Another view of the bay shows the five storage lines completely filled with molds.

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an arc-air process cutting and gouging torch. The cutouts were completed in less than 6 hr per casting. Finished work was smooth and satisfactory from a production standpoint, as shown in Fig. 8.

Fig. 9 illustrates the removal of a defect from a large steel casting. The procedure used for this operation is identical to that of washing riser pads in steel foundries. The electrode is moved from side to side, producing a smooth clean surface which often eliminates the need for grinding. This pad washing technique is common practice.

Nonferrous Alloys — In general, copper alloys yield to the process in ratio to their ability to conduct heat. Pure copper is difficult to cut in thicknesses over ½ in., but Monel, copper, nickel, and most bronzes can be cut by this torch with comparative ease.

Fig. 10—Blades from two manganese bronze propellers were removed with cuts up to 7 in.

Recently a naval shipyard removed the blades from two manganese bronze propellers with cuts up to 7 in. deep (Fig. 10). The as-cut surfaces are not as smooth as those on steel, but are entirely adequate for some work.

Aluminum can be cut with ease, but the surfaces are rough and unsatisfactory from the standpoint of appearance and need some further preparation for welding.

The chief use of the process in nonferrous foundries to date has been for the removal of large gates and risers difficult to attack by other methods. Removal of remaining stubs is accomplished by chipping or grinding.

Editor's Note: This article is from a paper presented at the Northwest Regional Foundry Conference held in Seattle, Oct. 2-3.

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Two views show head table at the Southeastern Regional Conference annual banquet

28th Conference Held by

SOUTHEASTERN FOUNDRYMEN

By FRANK G. STEINEBACH
Editor

● THE 28th annual Southeastern Regional Foundry Conference, the oldest consecutive foundry conference among AFS groups, was held at the Thomas Jefferson Hotel, Birmingham, Feb. 18-19. The affair had a total registration of 458, with 21 states represented.

The conference was sponsored by the Birmingham District, Tennessee, and University of Alabama Student Chapters. J. R. Cardwell, Stockham Valves & Fittings Inc., Birmingham, chairman of the Birmingham District Chapter, and Charles E. Seman, Crane Co., Chattanooga, chairman of the Tennessee Chapter, were co-chairmen of the conference committee.

A technical program dealing with both management and production problems featured the meeting. One morning was devoted to visits to a number of interesting plants in the Birmingham area. The annual banquet on Friday evening was addressed by Dr. V. Dewey Annakin, Indiana State College, Terre Haute, Ind., on "Backdrop for Survival."

Ashley B. Sinnett, secretary, AFS, outlined the many services the society offers to its members, including the results of committee activities, convention papers, research, safety and hygiene, publications, and training through the Technical & Research Institute. He predicted that much greater progress will be made during the next ten years than was recorded during the last 15, and stressed the importance of developing trained personnel to apply the results of stepped-up research in practice and product.

Resumes of technical papers follow.

A Sand for Both Nonferrous and Gray Iron Castings, by Clyde A. Sanders, vice president, American Colloid Co., Skokie, Ill. Factors that determine the types of equipment and sand used in the modern foundry were discussed. Slides showed many types of difficult castings which had been produced in green sand. Since many foundries encounter difficulties because of hot sand, adequate sand storage should be provided to give four times as much sand as metal poured.

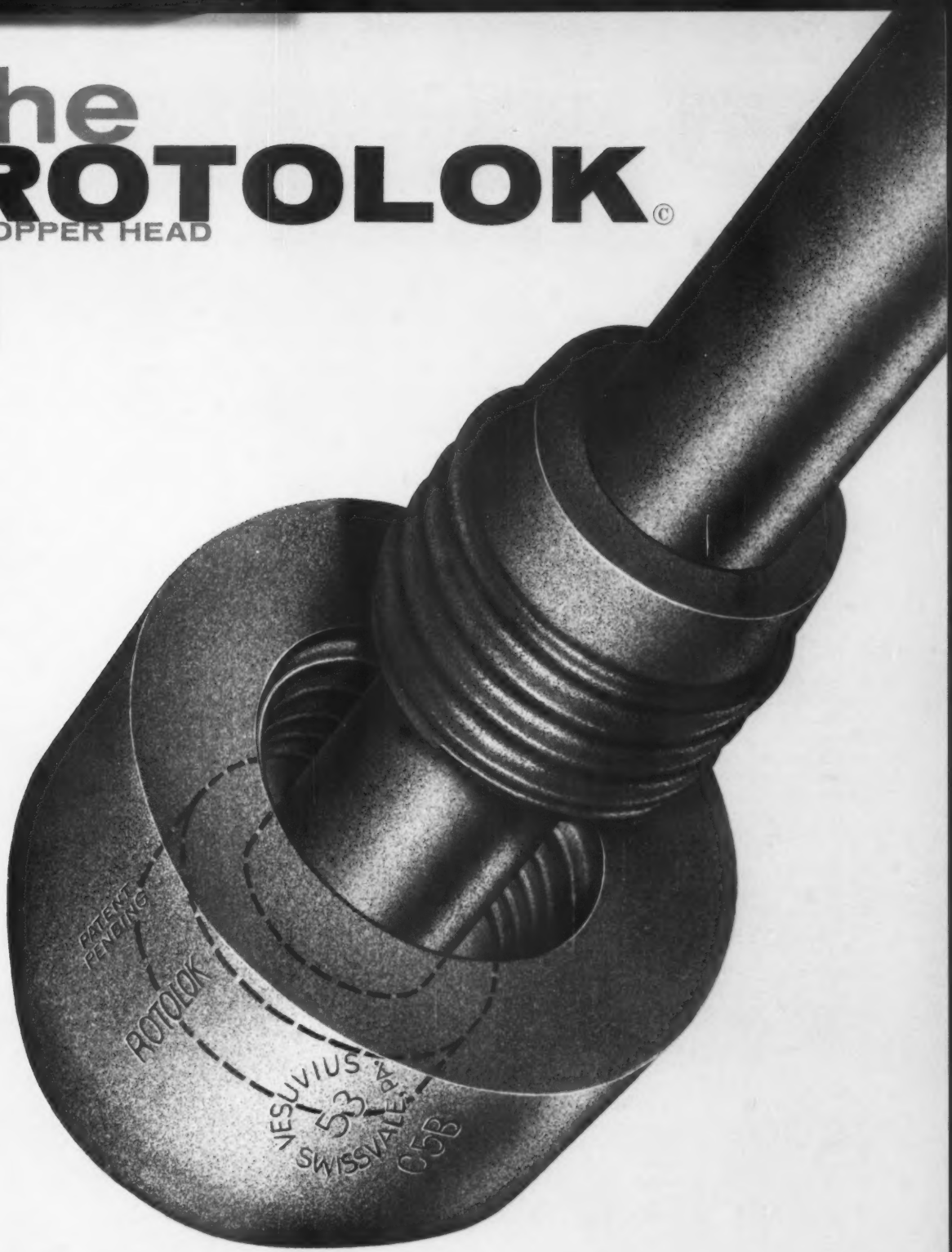
Longer mulling time also was suggested. Sand takes on new life when mulled, and obtains body which is urgently needed during ramming and lifting. The idea of talking about casting tolerance in microinches was criticized since the sand grain size is larger than the tolerance. Foundries must know what is in the sand. Careful study should be given to anything that may be added to sand to determine if it will be beneficial to the particular job.

Charging Materials for Cupola Melting, by Ralph A. Clark, manager, foundry service, Union Carbide Metals Co., Cleveland. The cupola has several decided advantages as a foundry tool. It produces continuous metal—an important aid to the mechanized foundry—and gives great flexibility in size of casting which can be produced and metal which it can melt. The metal

Chapter chairmen, left to right, are Charles E. Seman, Tennessee; T. T. Bales, Univ. of Alabama Student Chapter; and J. R. Cardwell of Birmingham Chapter

Circle 655 on Page 53→

the ROTOLOK©
STOPPER HEAD



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Promising New Alloys Save Weight Over Both Magnesium and Conventional Magnesium Alloys

In areas where lightness, strength, rigidity, formability and vibration dampening are important, Li-Mg alloys are being looked at very closely. These new alloys, containing small amounts of aluminum, equal or surpass the strength of more common Mg alloys.

Two considerations must be resolved before full commercial use of these alloys is established. First, the alloys over-age in two weeks from an as-cast tensile strength of 50,000-60,000 psi to a final strength of 25,000-30,000 psi. Also, the tensile strength is reduced rapidly at temperatures above 150°F, making insulation or cooling necessary where such temperatures are encountered. Both problems are now being worked on and are expected to be eliminated in the near future. Despite these limitations, however, many applications in a wide range of electrical and electronic components are already feasible for the alloys.

Most Li-Mg alloys are easier to machine than magnesium and sections of less than 1 inch are easily welded. They are workable at room temperature and when heated to 400°F are formable almost without limitation. In resonance, they compare favorably with standard Mg alloys. Up to 10% resonant frequency change is realized by substituting certain Mg-Li alloys for Mg counterparts, often reducing vibration stress where standard magnesium or aluminum parts in a structure have a resonant frequency within the critical range. This suggests extremely useful missile applications.

LITHIUM-CONTAINING SELF-FLUXING BRAZING ALLOYS EYED EXPECTANTLY

Aircraft Applications Prove High Heat Tolerance

Lithobraze 925, a self-fluxing silver brazing alloy containing .20% lithium, has been selected as the filler metal for brazing the 17–7PH stainless steel honeycomb sandwich panels of the B58 Hustler pictured *(below right)*. This lithium-containing self-fluxing alloy is ideal for the B58 application because *it withstands intermittent temperatures up to 800°F* from the exhaust stream and engine. In addition, it is not subject to crevice corrosion, requires no flux, brazes at lower temperatures – saving time, reducing atmosphere consumption and prolonging tool life. Also important is that at this material's brazing temperature, solution heat treatment of the base metal is also accomplished! Lithobraze 925 is manufactured by Handy & Harman.

Other lithium-containing self-fluxing brazing alloys have been produced by Handy & Harman to meet the requirements of specific applications. According to Mr. Donald C. Herrschaft, Assistant Manager of Handy & Harman's Brazing Products Division, the future for this type of brazing alloy looks bright. Numerous industrial uses are suggested by the heat resistant properties the alloys display as well as the ease of their use. Mr. Herrschaft is confident that as private industry realizes their value, sufficient demand will make possible volume production and prices more nearly competitive with those of alloys which require fluxing agents.

For further information call or write – Handy & Harman, 82 Fulton Street, New York 38, N. Y. or Lithium Corporation of America.

LITHIUM IN BRIEF

New developments involving lithium are constantly appearing in the literature. Each month some will be reported here. For further information, write our Technical Service Department in Minneapolis.

A new magnetic material can be prepared by heating ferric and chromic oxide hydrate with lithium carbonate. (1983).

Recently demonstrated fuel cell involves electrodes of lithium-nickel double oxide with good semiconducting properties. (1954).

A recent report reviews the properties of lithium carbide. (1917).

A recent U.S. Patent describes a wrought-aluminum base alloy containing lithium and copper as well as small amounts of manganese, cadmium and magnesium. Solution heat treatment and aging for greater strength are described. (1789).

Silver base brazing alloys containing lithium are discussed in a recent article. (1593).

An A.E.C. report discusses the preparation of high purity yttrium by reduction of the chloride by lithium. Yield and analysis of yttrium are included. (1647).

Newest Air Force bomber – the B58 – uses a brazing alloy containing lithium.

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is in close contact with incandescent coke, resulting in an increase in the carbon content during melting. This allows the melting of substantial amounts of steel scrap and such low-cost materials as briquetted turnings and borings.

In calculating the cupola charge the metallurgist merely proportions materials to introduce desired quantities of the elements of carbon, silicon, manganese, phosphorus, and sulfur, making due allowances for changes during melting. In most practices pig iron forms the basis for the cupola charge. Foundry returns or shop scrap is an excellent material of controlled analysis. Purchased cast iron scrap, when properly prepared for size, forms an excellent melting material, but generally varies more widely in analysis. Steel scrap is used to make the low-carbon, high-strength irons and also because it normally is the lowest cost material charged in the cupola.

Addition agents include low-silicon silvery iron, high-silicon silveries, ferrosilicon, ferromanganese, and briquets made of those and other alloys produced in the submerged arc furnace.

Ductile Iron Production and Control, by Harvey Henderson, technical director, Lynchburg Foundry Co., Lynchburg, Va. Control of any iron casting begins with the selection and preparation of materials to be melted. At Lynchburg the charge for ductile iron is melted in a water-cooled, protruding tuyere, 1000° F hot blast, acid-lined cupola. The 2000-lb charge consists of 500 lb of low-carbon, low-manganese pig iron; 700 lb of selected steel scrap as free as possible from carbide stabilizing and tramp elements, and 800 lb of ductile iron return scrap.

While it is possible to produce ductile iron from a high-sulfur base, it is not desirable for a number of reasons. It requires more magnesium alloy, which is expensive. Since sulfur and magnesium are both carbide stabilizing elements, the tendency to form carbides is much greater when treating high sulfur base irons. Presence of magnesium sulfide inclusions also is much greater. Addition of greater quantities of alloy increases the temperature loss and tends to increase the loss of magnesium. This loss of magnesium may cause the last iron in the ladle to contain wormy graphite. Desulfurizing with calcium carbide is employed to provide a base iron of consistently low sulfur content.

Modern Foundry Refractories, by James H. Rickey Jr., vice president-sales, Ironton Fire Brick Co., Ironton, Ohio. Although refractory manufacturers constantly try to develop improved materials that will give better performance at lower costs, some of the most dependable refractory products used today have been employed for many decades with good results.

In the gray iron foundry, acid type refractories include fire clay brick of all grades, fire clay plastics, siliceous gun mixes and ramming materials. Cost rules against lining and repairing the cupola each day with standard cupola block. Instead, a monolithic patch is applied quickly and cheaply each day. Proper grain size of the highly

ON *Your* CUPOLA...

WHAT COULD BLOWER BREAKDOWN

-Cost You?

Probably plenty! That's why . . . on original equipment or for replacement . . . foundrymen prefer SPENCER blowers, superior on many counts, including:

DEMONSTRATED DEPENDABILITY—Thousands in use for many years with no down time.

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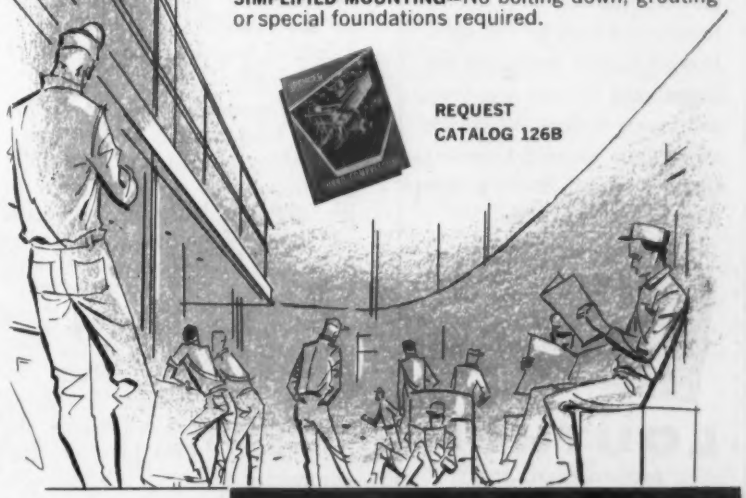

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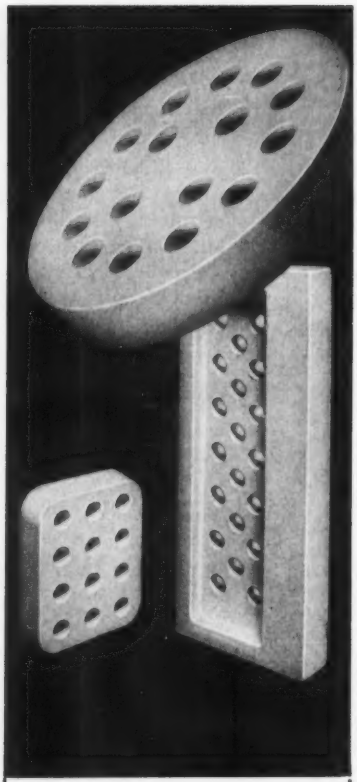


Louthan strainer cores cut foundry costs

You minimize casting problems, get cleaner castings when you use Louthan *refractory* strainer cores. Now available in more sizes and shapes—and for steel, iron, brass and bronze castings. All provide an accurate choke for positive control of metal flow, eliminate slag and oxide inclusions.

Write for Free Gating and Risering Refractory Folder. Complete file of specifications on all Louthan products.

LOUTHAN

EAST LIVERPOOL, OHIO

A UNIT OF FERRO CORPORATION

Refractories Division

Circle 657 on Page 53

siliceous clay mix will reduce the amount of rebound and drop when the material is applied with a gun, and will provide a dense material which will not slump after it is installed. Excessive moisture will cause cracking and spalling as the lining is dried and put into use.

A super quality material should be used in the cupola well. Some use a graphite bearing plastic having a low fusion point. When in contact with the molten metal the surface of the refractory melts and becomes glazed, and although this does erode, the action is quite slow. This type of refractory also is used in rammed tap holes and slag holes in back-slagging cupolas and on tap hole and trough on front-slagging cupola. Use of refractories on other types of melting units also was discussed.

New Opportunities for the Pattern Industry, by M. K. Young, marketing manager, Industrial Gypsum & Lime Div., United States Gypsum Co., Chicago. Unfortunately, there has been a disturbing lack of acceptance of plastic patterns by foundrymen, and a lack of pioneering spirit by patternmakers to sell the merits of plastic patterns.

Several ideas are advanced to account for the industry's reluctance to use plastics, including the following: 1. Phenolics have made a bad impression; 2. The industry is resistant to change (although this is debatable); 3. Many in the industry are basically lazy; 4. There is a lack of knowledge in the use of plastics and allied materials.

Mr. Young presented information on the fundamentals of plastic patternmaking by means of a new film showing step-by-step procedures in laminating and casting operations, and slides of plastic patterns that have been in service two or three years.

Patternmakers should not tackle the toughest plastic pattern first. They should not bid on plastic pattern equipment without first doing experimental work to master the steps involved. Furthermore, patternmakers should not be discouraged if the first one sticks in the mold or if there are sand adhesion problems. Last, but not least, patternmakers should not hesitate to call their suppliers when in trouble.

Pouring Effect on Reliability, by C. E. Drury, divisional director of reliability, Central Foundry Div., General Motors Corp., Saginaw, Mich. Investigation of effect of three types of sprue cups on pouring rate and castings defects was reported.

Tests showed that as the pouring rate increased, severity of slag increased on parts prone to slag. Slag was found regardless of whether or not skim cores were used. As the iron velocity in the runners decreases, slag defects are minimized. Therefore, skim cores do not remove slag directly but do it by reducing the pouring rate and iron velocity in the constant runner area. A skim core in the cope is most effective in reducing the pouring rate, but a skim core in the runner is practically ineffective in reducing the pouring rate. Skim cores in the gating system can be eliminated if other means, such as smaller sprue ports or choking the runner, are used to reduce the pouring rate.

Shell Molding and Shell Cores, by Carl O. Schopp, assistant general superintendent, Link-Belt Co., Indianapolis. Since the tolerance secured in the casting can be no better than the pattern, it is important that accurate pattern equipment be used. Sand used by his plant is a Juniata bank of 92 AFS fineness. The mix has 65 per cent new sand, 35 per cent reclaimed sand, and powdered resin is used. The cold coated method is used

"Vacuum casting comes naturally to him"

for mixing sand and resin, and a resin with release agent added is used. Molds are placed on a tilting tray of a trolley conveyor and poured while horizontal. The speaker believes that shell molding will continue to grow.

The company is just starting to make shell cores, and this method appears to offer great possibilities. A number of examples of materials and direct labor costs for baked sand cores and shell cores showed a cost advantage in most cases for the shell cores.

The Air We Breathe—Is It Free? by John B. Skinner, chief, Industrial Hygiene Section, American Mutual Liability Insurance Co., Boston. When materials introduced to the air are ones not normally found there, or when the amounts of materials introduced are greatly in excess of those normally found there, the resulting condition is described as atmospheric pollution. Foundries have in-plant contamination of their air from dusts containing free silica; from the fumes of various metals such as beryllium, lead, zinc, iron, tin; and nonmetals such as fluorine, tellurium and phosphorus, or their compounds; and from gases such as acrolein or aldehydes.

Over the years sufficient experience has developed with these contaminants to enable foundries to control atmospheres containing these materials to within tolerable limits. The most widely used control method is exhaust ventilation. Unless proper precautionary steps are taken, this control measure can contribute to the pollution of the atmosphere outside the foundry. It is, therefore, necessary in many cases to clean the air discharged—often an expensive procedure. For example, in the Los Angeles County basin in recent years, $93 million has been spent for control equipment by industry, and the annual cost of operating this equipment is said to be $6.5 million. With such sums being spent on the air, it is apparent that it is no longer free.

Steel Castings in Competition with Other Materials, by Clyde B. Jenni, chief metallurgist, General Steel Castings Corp., Eddystone, Pa. Steel castings are a dependable product containing many inherent beneficial properties. They play a tremendous role in the complex modern civilization, being necessary components for power generation, transportation, metalworking, mining and ore dressing, road building, construction, and numerous other industries.

Design engineers can choose steel castings from a wide variety of mechanical properties. Intricate shapes can be produced with the most efficient distribution of metal and good weight-strength ratios. Engineering studies and stress analyses are needed so that enlightened designs will result, providing better service performance and, at the same time, permit intelligent foundry practices.

High Demand for Iron and Steel Scrap Predicted for 1960

Iron and steel scrap processors and brokers will ship about 32-34 million gross tons of scrap to domestic steel mills and foundries and to export markets in friendly foreign nations in 1960. This forecast was made by Edwin C. Barringer, executive vice president, Institute of Scrap Iron and Steel Inc. This figure compares with a total of 28 million tons handled in 1959.

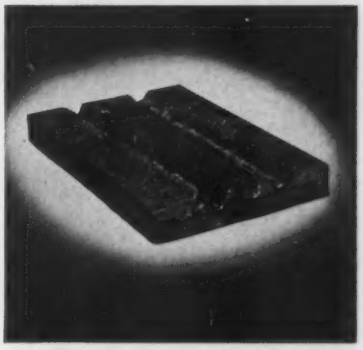
The estimate is based on steel industry forecasts of near-capacity production of ingots during the coming year as well as on estimates that demand from abroad will continue to help scrap dealers in areas away from major steel-consuming centers.

Domestic demand for scrap is expected to be about 30 million tons in contrast to about 24 million tons for 1959.

AFS Releases Film Showing Role of Metal Castings

The Education Division of the American Foundrymen's Society has released a new film, "Cast Metals and You," which depicts the role of metal castings in the everyday lives of modern men. It is said to appeal to all types of organizations—industrial, civic, and educational.

The film is available from AFS, Golf and Wolf Roads, Des Plaines, Ill. Educational institutions and civic groups pay only transport charges; others pay a rental fee of $10 plus shipping.



Which cast iron groove was made in just 42 seconds?

The metal is cast iron. Grinding out the six-inch groove on the right took 5 minutes, 36 seconds. Using the Arcair process, the groove on the left was made in 42 seconds—*eight times faster!*

You can cut, gouge, bevel or groove *any* metal using the Arcair method—and get dramatic cost savings with an investment of much less than $100.

HOW DOES ARCAIR WORK? The torch utilizes air from an 80 p.s.i. air line, current from a welding machine and special electrodes to melt and remove metal. Fifteen minutes instruction is all an operator needs.

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Arcair

THE ARCAIR CO., 465 S. Mt. Pleasant St. Lancaster, Ohio

Send me more information on Arcair Torches and special electrodes.

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TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

MY PROBLEM_____

Circle 658 on Page 53

The 180-cycle Multiductor, a low-cost static frequency converter, permits the use of induction on heating and melting applications where costs were previously prohibitive.

THE NAME WITH THE FAMILIAR RING!

The Multiductor, one of several Power Sources . . . another major product line of AM for the heating or melting of metals by Induction.

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Trenton 5, New Jersey

YOUNGSTOWN DIVISION
3990 Simon Road
Youngstown 1, Ohio

Literature for Foundrymen

For More Information Use Reply Card—Page 53

Beryllium in Aluminum Alloys

Bulletin 12 discusses advantages of beryllium in aluminum alloys.—Brush Beryllium Co., 4301 Perkins Ave., Cleveland 3, Ohio.

For More Details Circle No. 406—Page 53

Mold Coating and Spray

Bulletins describe Ferro Kote core and mold coating and No Dri green sand mold spray.—Thiem Products Inc., 9800 West Rogers, Milwaukee 14, Wis.

For More Details Circle No. 407—Page 53

Blast Cleaning

Rotoblast table-rooms are shown in Bulletin 805, which also gives complete dimensions and specifications.—Pangborn Corp., P. O. Box 380, Hagerstown, Md.

For More Details Circle No. 408—Page 53

Band Machines

Eight-page catalog covers Zephyr line of high-tool-velocity band machines. Uses, design details, specifications, and attachments are described.—DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

For More Details Circle No. 409—Page 53

Diecasting Ladles

Folder describes and gives dimensional data on stainless steel diecasting ladles for permanent mold and diecasting.—Spincraft Inc., 4141 W. State St., Milwaukee 8, Wis.

For More Details Circle No. 410—Page 53

Obsolescence and Profit

"Tom Swiftly and his Timed Machines" analyzes profit potential of an old machine versus a new one.—Lester-Phoenix Inc., 2711 Church Ave., Cleveland 13, Ohio.

For More Details Circle No. 411—Page 53

Rust and Corrosion Control

"Color Horizons" is a 38-page catalog on rust and corrosion control by protective coatings. The manual, Form 259, accents color, and includes technical data, photos of applications, and color chips.—Rust-Oleum Corp., 2799 Oakton St., Evanston, Ill.

For More Details Circle No. 412—Page 53

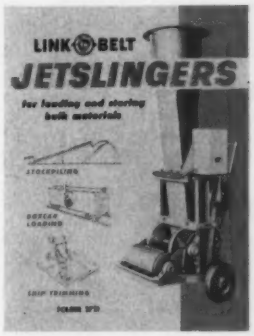
Product Bulletin

Bulletin P2547P outlines products of the company, including air and hydraulic cylinders, accumulators, hydraulically controlled air power units, boosters, and pipethread fittings.—Flick-Reedy Corp., York and Thorndale Roads, Bensenville, Ill.

For More Details Circle No. 413—Page 53

Bulk Material Hurler

Six-page Folder 2721 describes the three types of Jetslingers, bulk material han-



dling units, including dimensional data.—Link-Belt Co., Dept PR, Prudential Plaza, Chicago 1, Ill.

For More Details Circle No. 414—Page 53

Dust Collectors

Series 342 dust collectors are described and illustrated in Bulletin 1828. Bulletin also contains two nomogram presentations which simplify engineering calculations relating to the collectors.—American-Standard, Industrial Div., 8111 Tireman, Detroit 32, Mich.

For More Details Circle No. 415—Page 53

Did You Miss These?

Here is a list of popular literature items offered in recent months:

FOUNDRY FACTS ("Foundry Facts—Metal Casting of Brass, Bronze, and Aluminum") — Crucible Manufacturers' Association, New York 36, N. Y. Circle 402, Page 53.

ALUMINUM CASTING ALLOYS — U. S. Reduction Co., East Chicago, Ind. Circle 403, Page 53.

COMPRESSED AIR FUNDAMENTALS (Booklet 1548) — Ingersoll-Rand, New York 4, N. Y. Circle 404, Page 53.

CHEMICAL PRODUCTS — Borden Chemical Co., New York 17, N. Y. Circle 405, Page 53.

Steel Doors

Bulletin is a 16-page maintenance and parts manual for rolling steel doors. Illustrations and specifications are included.—Rolling Steel Door Div., R. C. Mahon Co., E. Eight Mile Road at Sherwood, Detroit 34, Mich.

For More Details Circle No. 416—Page 53

Sand Binder

Use of sand binder 230 is outlined in a bulletin.—Technical Service and Development, Dow Chemical Co., Midland, Mich.

For More Details Circle No. 417—Page 53

Cobalt-Tungsten Alloy

Booklet describes stress-rupture properties of WI-52 cobalt-tungsten alloy. — WaiMet Alloys Co., 5320 Oakman Blvd., Dearborn 2, Mich.

For More Details Circle No. 418—Page 53

Fire Extinguishers

Interior fire fighting equipment is indexed and described in Catalog S-62. Engineering facts and specifications are included.—Fyr-Fyter Co., Customer Services Dept., 221 Crane St., Dayton 1, Ohio.

For More Details Circle No. 419—Page 53

Noise Integrator

Bulletin 0818-3 describes functions and features of a noise integrator.—Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.

For More Details Circle No. 420—Page 53

Weighing Systems

Brochure covers descriptions of typical heavy-duty applications of load cell weighing system and its advantages.—Howe Scale Co., Rutland, Vt.

For More Details Circle No. 421—Page 53

Soft-Faced Hammers

Catalog illustrates soft-faced industrial hammers.—Metocraft Alloy & Plastic Co., 1039 Memorial Ave., West Springfield, Mass.

For More Details Circle No. 422—Page 53

Hardness Testers

Microhardness testers are covered in Bulletin K-59.—Kent Cliff Laboratories Div., Torsion Balance Co., Clifton, N. J.

For More Details Circle No. 423—Page 53

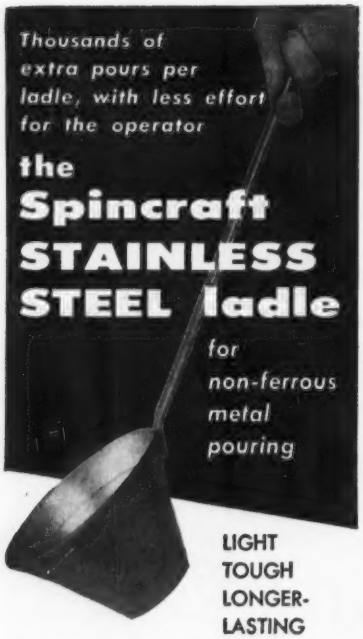
Conveyor Systems

Two Cable-Veyor systems are described in Bulletin H-556-A. Dimensional en-

Thousands of extra pours per ladle, with less effort for the operator

the Spincraft STAINLESS STEEL ladle

for non-ferrous metal pouring



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If you pour non-ferrous alloys, Spincraft ladles will save you replacement costs and make the job much easier. Designed to reduce operator fatigue by their lightness, balance, and non-spill shape, they resist burning-through as only stainless steel with its high critical melting point can do. Spincraft ladles come in 23 sizes, from ¼ lb. to 30 lb. molten metal capacity.

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- Shot-blasted for coating adhesion
- Deep conical form makes pouring easier, minimizes spillage
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- "Whack proof" handle arc-welded to reinforced cup edge
- Built to last longer, work lighter. Let your operator use one, then try to take it away from him!

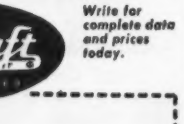
Complete handle on ¼ lb. through 9 lb. size; 10 through 30 lb. size has handle bracket stub to which proper length handle can be attached.

Also...Spincraft STAINLESS STEEL Skimmer

A skimmer that really skims! Shallow radius skims surface impurities instead of ladling as deeper-cupped skimmers do. Correct size holes prevent clogging. Short handle stubs fit common pipe and permit attachment of length and type handle you want.

IN FOUR DIAMETERS: 6 inch, 8 inch, 10 inch, 12 inch.

Spincraft ladles and skimmers are also available in low-cost mild steel.



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☐ Skimmers	☐ Skimmers

Company .....

Address .....

City ..... State .....

Name .....

Circle 660 on Page 53

gineering drawings are included.—**Conveyor Div., Hapman Corp.,** 630 Gibson St., Kalamazoo 6, Mich.

For More Details Circle No. 424—Page 53

Process Industry Equipment

Catalog 978 outlines feeders, conveyors, coolers, dryers, weigh feeders, vibrating screens, bin check valves, and magnetic separators. — **Jeffrey Mfg. Co.,** 907 N. Fourth St., Columbus 16, Ohio.

For More Details Circle No. 425—Page 53

Temperature Control

Bulletin GER-1206 is a 24-page reprint of a series of articles on temperature control of heat treating furnaces which appeared in STEEL. Reprint contains information on thermocouples, control instruments, control elements, control systems, and special systems.—**General Electric Co.,** 1 River Rd., Schenectady 5, N. Y.

For More Details Circle No. 426—Page 53

Magnetic Pulleys

Features of electromagnetic pulleys and nonelectric, ceramic-type Perma-Pulleys are explained in Catalog C-2000. Dimensional information is provided. — **Dings Magnetic Separator Co.** 4740 W. Electric Ave., Milwaukee 46, Wis.

For More Details Circle No. 427—Page 53

Fire Equipment

Complete line of fire equipment is outlined in Catalog 1960. The 20-page catalog contains descriptions, illustrations, and specifications.—**Ansul Chemical Co.,** 1 Stanton St., Marinette, Wis.

For More Details Circle No. 428—Page 53

Grouting Practices

Bulletin E-1d describes and illustrates use of Embeco grout. Information on recommended mixes and estimating tables are included.—**Master Builders Co.,** 7016 Euclid Ave., Cleveland 3, Ohio.

For More Details Circle No. 429—Page 53

Rotary Air Compressors

Specifications and features of industrial rotary stationary compressors are given in Bulletin E-269.—**Davey Compressor Co.,** Myers Avenue, Kent, Ohio.

For More Details Circle No. 430—Page 53

Testing Equipment

Catalog for 1960 features descriptions and illustrations of laboratory testing equipment. The 316 pages also contain recommended equipment lists for specific types of testing projects.—**Soiltest Inc.,** 4711 W. North Ave., Chicago 39, Ill.

For More Details Circle No. 431—Page 53

Temperature Indicator

Bulletin outlines features of Series BH180 Autotemp temperature indicator.—**B & H Instrument Co.,** 3479 West Vickery Blvd., Fort Worth 7, Texas.

For More Details Circle No. 432—Page 53

Aluminum Alloys

Brochure 28-114-10 contains information on aluminum pig and ingot, to aid in selection of aluminum alloys for use in producing castings.—**Aluminum Co. of America,** 726 Alcoa Bldg., Pittsburgh 19, Pa.

For More Details Circle No. 433—Page 53

Centrifugal Compressors

Bulletins 16B9485 and 16B9486 give standard ratings, dimensions, and list prices for single-stage centrifugal compressors.—**Allis-Chalmers Mfg. Co.,** 1126 S. 70th St., Milwaukee 1, Wis.

For More Details Circle No. 434—Page 53

Cylinder Ports

Bulletin S-113-1A covers advantages of straight thread cylinder ports. Specifications and dimensions are included.—**Hannifin Co.,** division of Parker-Hannifin Corp., Dept. 238, 501 S. Wolf Rd., Des Plaines, Ill.

For More Details Circle No. 435—Page 53

Hoists and Hoist Cranes

Four-page Bulletin E-313 contains descriptions and technical data on Hi-Lift hoists and hoist cranes.—**Northern Engineering Works,** 210 Chene St., Detroit 7, Mich.

For More Details Circle No. 436—Page 53

Fitting Safety Shoes

Booklet illustrates how to fit safety shoes properly. Step-by-step instructions are given.—**Hy-Test Safety Shoe Div., International Shoe Co.,** 1509 Washington Ave., St. Louis 66, Mo.

For More Details Circle No. 437—Page 53

Hand Torches

Catalog ADC 702E contains detailed information on gas welding and cutting hand torches, outfits, tips, and accessories.—**Air Reduction Sales Co.,** division of Air Reduction Co. Inc., 150 E. 42nd St., New York 17, N. Y.

For More Details Circle No. 438—Page 53

Portable Electric Hoists

Complete listing of specifications and prices for pushbutton and pull cord control models of Budgit portable electric

hoists are contained in bulletin.—Shaw-Box Crane & Hoist Div., Manning, Maxwell, and Moore, Muskegon, Mich.
For More Details Circle No. 439—Page 53

High-Intensity Film Illuminator

Bulletin covers features, applications, construction, and operation of a high-intensity film illuminator. — Princeton Div. Curtiss-Wright Corp., P. O. Box 110, Princeton, N. J.
For More Details Circle No. 440—Page 53

News Letter

Quarterly publication, *Arcair News*, presents case studies and information on use of the company's electric arc cutting torches—Arcair Co., P. O. Box 431, Lancaster, Ohio.
For More Details Circle No. 441—Page 53

Dust Control Equipment

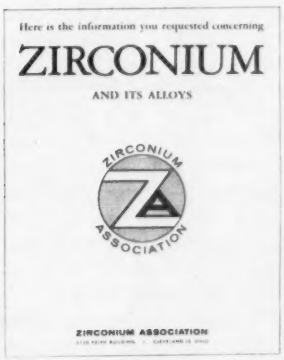
"Freedom From Dust," Bulletin 805, describes dry collection equipment. Twenty-eight page brochure gives specifications and illustrated application data.—Dracco Div., Fuller Co., Harvard Avenue and E. 116th Street, Cleveland 5, Ohio.
For More Details Circle No. 442—Page 53

Electric Hoists

Bulletin gives capacities and dimensions of electric hoists.—American Engineering Co., Wheatsheaf Lane and Sepviva Street, Philadelphia 37, Pa.
For More Details Circle No. 443—Page 53

Zirconium

Fact file contains technical data on zirconium. Information on applications



and available forms of zirconium are included. — Zirconium Association, 2130 Keith Bldg., Cleveland 15, Ohio.
For More Details Circle No. 444—Page 53

Power Tools

Power tools are described and illustrated in Catalog 60.—Boice-Crane Co., 907 W. Central Ave., Toledo 6, Ohio.
For More Details Circle No. 445—Page 53

Furnaces and Ovens

Furnaces and ovens for aluminum are featured in Bulletin 128.—W. S. Rockwell Co., 200 Eliot St., Fairfield, Conn.
For More Details Circle No. 446—Page 53

KEOKUK KONTROLS KUALITY
PIN YOUR KOAT WITH KEOKUK the Kuality Kandidate
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Chief Keokuk hits it "right on the button" with Kemco Silvery . . . the superior form of silicon introduction! Declare yourself a member of the Kemco party and wear the Keokuk button. Back the Chief's platform of "Quality plus Economy" . . . write for free campaign buttons for yourself and your friends. And when you vote for Silicon . . . vote for KEMCO.*

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Kemco Silvery melts uniformly for quality . . . holds silicon loss to a minimum for savings. Your choice of 60 lb. or 30 lb. pigs or 12½ lb. piglets in regular or alloy analysis for iron and steel production. Write for full information . . . get a copy of booklet, "For Lower Costs, Higher Quality Products." Also check the performance of Kemco Silicon Metal in aluminum.

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**You can also get Chief Keokuk buttons at the AFS Foundry Show, May 9-13, Philadelphia. Visit our interesting display!*

Circle 661 on Page 53

Around the Country

NEWS REPORTS FROM

Boston . . . Philadelphia . . . Pittsburgh . . . Chicago

Boston— Orders for gray and malleable iron castings are slightly heavier, but foundry backlogs are slow to build up. Most tonnage is for April and May delivery, and to meet shipment demands, shop schedules are flexible. More shops are operating on a five-day per week schedule, but around 75 per cent capacity. Textile mill equipment plants average somewhat above that level.

Machine tool builders have slightly more volume booked, but do not look for any substantial spurt until after the Machine Tool Show in the fall. Shops assembling machines for the plastics industry have booked more orders, and casting requirements are heavier. The lag in automobile sales and cutbacks in production have a somewhat depressing influence.

A lower commodity freight rate on pig iron from Beacon, N. Y., to most New England consuming points is in operation. To most Connecticut, Rhode Island, and western Massachusetts destinations, the new rate is $5.10 per gross ton compared with $5.40 formerly. To Boston and eastern Massachusetts, the rate is $6.47, down from $6.77, and to Hopedale, Mass., the rate is $6.73 compared with $7.03.

Rather slow recovery from the late 1959 slump indicates that in the second half, 1960, both iron and nonferrous shops will pour more metal than during the first six months, or at least the first quarter, thus reversing the current trend in finished rolled steel products. Jobbing shops will show spotty improvement in April—notably aluminum foundries producing fine work for electronics.

Shipyard strikes have an adverse effect on brass demand. Plumbing goods, meters, valves, and pumps hold steady with some spasmodic improvement due to seasonal factors. The same holds true for castings needed by building trades and for highway drainage.

1½ MILLION SAFE HOURS: Employees of Aluminum Co. of America's Cleveland sand foundry recently were presented a plaque for having worked almost 1½ million manhours without a lost-time accident. The plaque was made in the plant and was presented by W. R. Gilliland (second from right), assistant safety manager for Alcoa from Pittsburgh. Also shown, from left to right, are Frank Haluska, works medical and safety administrator; A. H. Hinton, sand foundry manager; and I. S. Dow, works manager, all of Alcoa's Cleveland plant

Philadelphia—While edging up slightly, ferrous casting demand is generally disappointing to producers. Competition is sharp, and some job shops have been forced to a four-day week operation.

One large gray iron shop reports shipments for the first two months are 10 per cent ahead of a year ago, but at the expense of backlogs. A year ago backlogs were on the increase. Shipments appear to have leveled off in March but with actual buying a shade better.

One reason for the disappointing showing in first quarter demand, it is believed, was the build-up of casting inventories by many consumers during the steel strike.

Broadly, it is touch and go with gray iron shops, with backlogs averaging less than two weeks. Consumption is holding up well in the papermaking and textile lines; also vacuum pump machinery business is fairly good. But the situation in general is spotty.

Steel casting business reflects the lag in ship work and heavy industrial equipment. Plants are working four to five days a week, with backlogs light considering the operations involved. Malleable shops are still operating relatively well, but there is less buying pressure. Hardware requirements are not up to the level anticipated for this time of the year and there is a leveling off in pipe fittings. Nevertheless most malleable shops are operating full five-day week schedules.

Demand for brass and bronze castings is decidedly spotty. Many job shops consider themselves lucky if they can operate four days a week. Rarely are operations at a higher level with a full working force. Dullness is affecting both the captive and independent shops. Reflecting a rather disappointing number of housing starts, meter and

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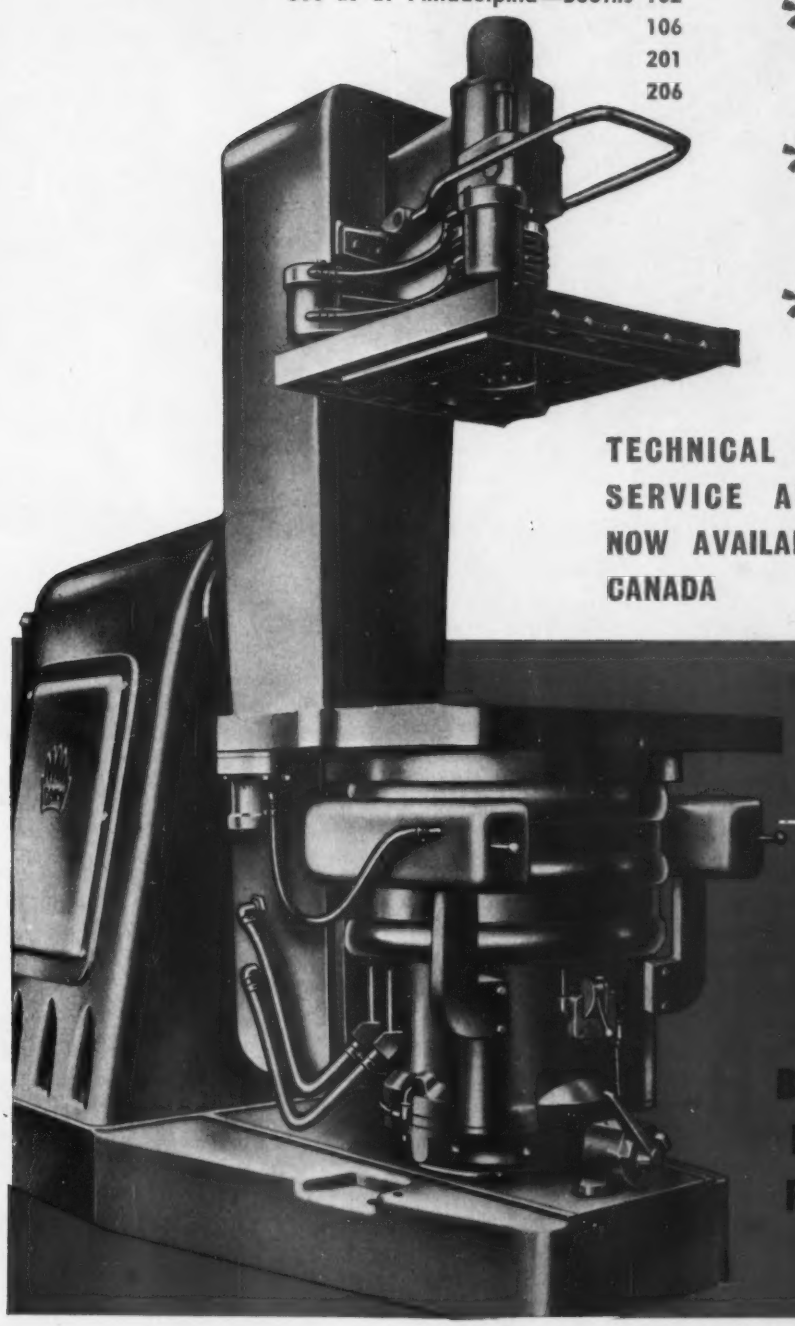

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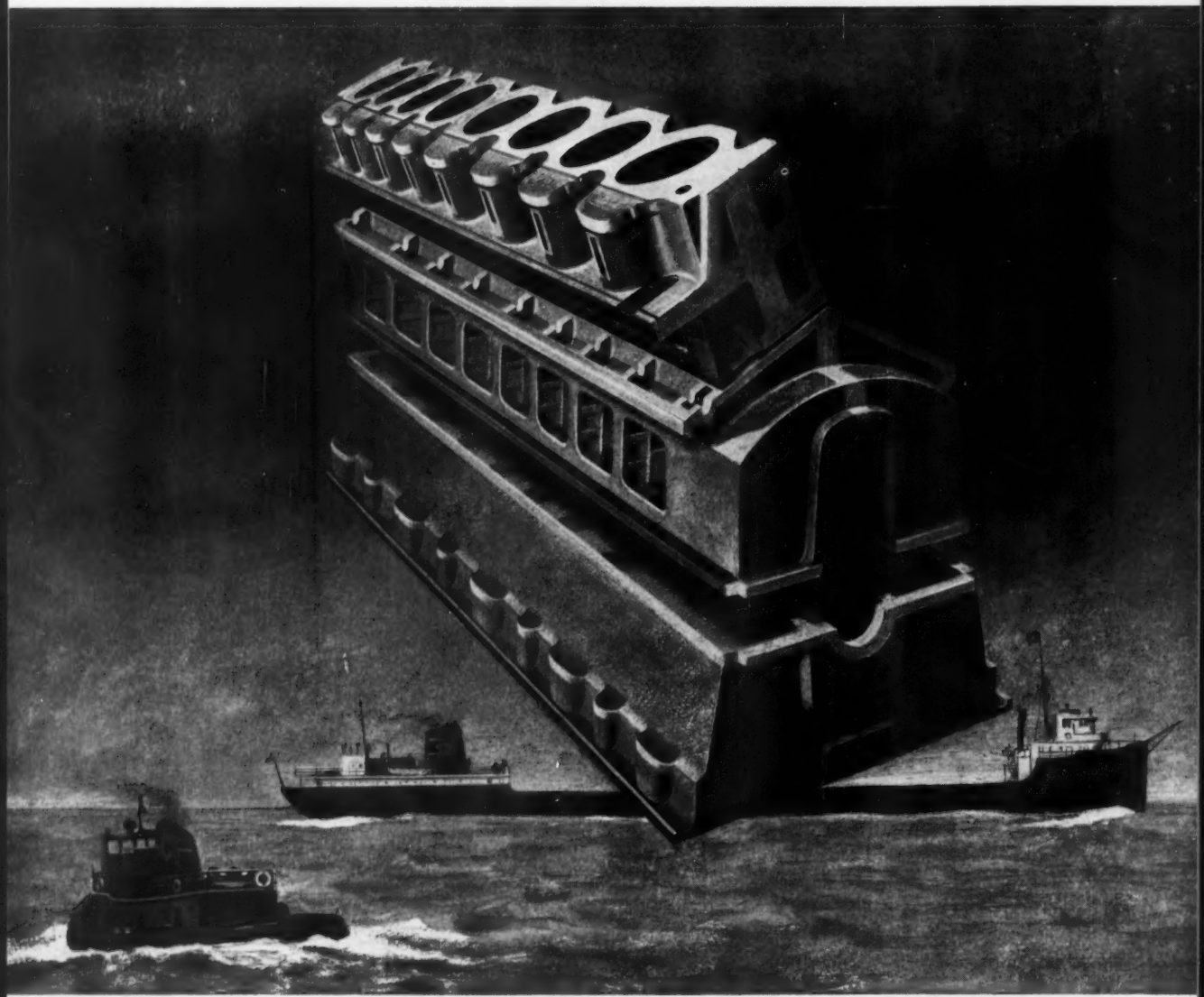

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Fabrication of steel was first specified for this 35,000-lb. crankcase of a 7700-hp. marine diesel engine. But, after careful study, the obvious advantages of gray iron dictated the final choice of a gray iron casting.

The excellent vibration damping characteristics of gray iron assure the lowest possible noise level. The rigidity and mass which is easily designed into a casting contributes to permanent alignment. Gray iron gives good engine heat distribution. The inherent stability of gray iron eliminates need for stress relieving. And because of the large amount of drilling and tapping required, the easy machinability of gray iron is an important advantage. All of these qualities were taken into consideration before the specifications were changed from steel weldment to gray iron casting.

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Facts from files of Gray Iron Founders' Society, Inc.

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plumbing supply is off. Red metal shops also are feeling the lag in ship work. Aluminum foundries continue to do better than the red metal shops, but backlogs are not extended.

Pittsburgh— Although first-quarter results varied somewhat from one foundry to another, there's agreement among the leading firms that sales were about 10 per cent higher than in the corresponding period of 1959.

Whether the improvement can be maintained depends largely on steel industry plans for capital equipment spending. Foundrymen point out that a 10 or 15 point drop in the steel ingot rate for the next two quarters wouldn't be nearly as harmful as the postponement of projects calling for replacement of mill equipment. When steelmaking operations decline, there's a cutback in purchases of castings for mill maintenance and repairs, but this business is of minor importance compared with purchases of heavy castings by mill machinery manufacturers.

One of the district's largest gray iron foundries says its steel industry customers have allowed their inventories of replacement castings to fall very low. "They're pressing us for immediate delivery," a sales executive comments. "The stuff we're shipping them now is going right on the mills."

In most instances backlogs at gray iron foundries are small. The top sales official of a firm currently running at 80 per cent of capacity reports that his backlog of castings in the 200 to 8000-lb range is "zero." In heavy castings (30,000 to 40,000 lb), there's enough work for two months. In small castings (under 100 lb), the backlog is about 30 days.

Prices remain highly competitive, but foundrymen are hopeful that as operations build up, purchasing agents will be less intent on squeezing the last nickel out of a quotation. There are encouraging signs of renewed interest in quality. Says one foundryman: "People who said that we were too high are now coming back to us. They found that higher machining costs more than offset any price advantages they got by dealing with our competitors."

Unsolved problems for district foundrymen include competition from southern firms which have established sales offices here. Their labor rates are so much lower than hourly wages paid here that they can undersell local foundries in spite of higher freight costs.

Steel foundries report that business is spotty. One firm started the year well, then saw orders decline—almost as though they were tied to the stock market. Purchases by the steel mills haven't been up to expectations, but there's a marked improvement in railroad orders. After much delay, the carriers are getting started with some ambitious car building programs.

Although current operations at steel foundries average only 50 to 60 percent of capacity, they would be lower if it weren't for seasonal factors. Power shovel manufacturers are at the height of their season, building equipment for sale in spring and summer. Construction firms and bridge builders are fabricating steel in their shops so that they can hog in field work as soon as the weather permits.

Chicago— Last year's opening of the St. Lawrence Seaway is sparking in the Midwest metalworking industry a foreign trade consciousness that hasn't existed before.

Heretofore the rising imports of iron and steel products and the decline in exports has been largely a matter of concern in coastal areas. By now the iron and steel industry is aware that in 1959 for the first time the United States became a net importer of steel mill products. Imports increased 259 per cent last year and exports dropped 44 per cent.

More foreign pig iron became available to foundries last year, and iron producers are well aware of the growing competition they face. Pig iron imports jumped from 209,743 net tons in 1958 to 699,200 tons in 1959.

Domestic pig iron production in 1959 was 60,322,426 tons; consequently imports represented only 1.15 per cent. But imports were 13 per cent of the 5,398,006 tons of iron which domestic blast furnaces shipped to nonintegrated steel ingot producers, to independent ingot mold makers, and for foundry use. In 1958, pig iron imports repre-

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sented only 5.1 per cent of the 4,079,255 tons which furnaces shipped to others.

By countries of origin, 1959 pig iron imports rose as follows: Canada, from 182,128 tons to 434,522 tons; Netherlands, 1126 to 35,080; West Germany, 13,934 to 43,226; Australia, 2737 to 4167; and Japan, from none in 1958 to 10,674 in 1959.

Of the 489,457-ton increase in pig iron imports in 1959, the greater portion came in through Canadian border and inland ports. The figure was 258,343 tons. The gain at Atlantic coast ports was 164,880 tons, and 31,473 tons at West coast ports. Gulf coast ports, which reported no pig iron imports in 1958, handled 34,594 tons in 1959.

Three customs districts got the bulk of the tonnage increase reported for the Canadian border and inland ports. For example, in the Michigan district, foreign iron rose from 155,893 tons in 1958 to 263,155 tons in 1959; Chicago, from 8428 to 96,725; and Ohio, from 8334 tons to 50,691 tons.

There is no question but that the 116-day steel strike was a considerable stimulant to pig iron imports as it was to imports of rolled steel products. Nevertheless, qualified marketmen say a long-term uptrend in imports has been under way for some time. The tonnage may drop somewhat this year, they say, but the volume during this decade will be at a higher level than during the 1950's.

Birth of a Foundry

By LEO H. SIMONS

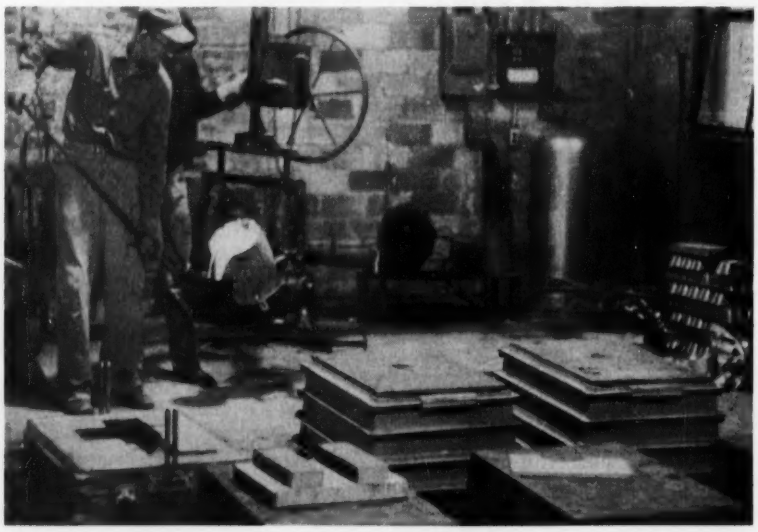
● FOUNDRIES, like American industry in general, are tending to become bigger and fewer, but there's still room for the little fellow to get into the field. Anoka Brass & Aluminum Foundry, Anoka, Nebr., is one such small newcomer to the metal casting business.

Established last year, the company has a capacity of 1 ton of brass or 1/3 ton of aluminum per day. The owner is Walter Salmen, who formerly was associated with Paxton-Mitchell Co., Omaha, Nebr., for 20 years, and with Omaha Steel Works, Omaha, for 7 years. He and his son Richard are the owners, and they have one full-time employee and one part-time.

The foundry is in operation in a former bank building which had been unused for many years. Of brick construction, 25 x 40 ft, it is well suited for the purpose, but already is becoming a bit cramped. As a result, an expansion is being planned which will triple the size of the operation. Mr. Salmen has acquired adjacent lots, which will be used for stockpiling and for expansion as required.

At present, Anoka Brass & Aluminum is producing castings for irrigation and farm machinery, plaques, street markers, door markers, and grave markers. It can pour brass castings weighing up to 70 lb.

Anoka is a town with a population of fewer than 100, but the Salmens wanted to set up their plant where the air is pure, taxes and rent are low, traffic is no problem, and the atmosphere is neighborly. Anoka fills the bill. It is in north central Nebraska, a short distance from the Fort Randall recreation center in South Dakota. Attractions there include excellent year-round fishing and waterfowl and pheasant hunting in season.



Above, Walter Salmen, owner, is shown touching up a sand core. Below, molten aluminum is being poured from a crucible into a ladle. Plant capacity is 1/3 ton of aluminum or 1 ton of brass daily

Gray Iron Foundry Milestones—No. 3

IN THE 16th and 17th Centuries, Central Europe made tremendous strides in the use of iron, a cast metal relatively new to the Continent. Prior to this era, iron had been referred to as a "base" or "corrupted" metal, with the more attractive bronze and brass in greater favor.

In spite of this prejudice, cast iron had demonstrated its usefulness and serviceability in the forms of firebacks, tombstones, weights, anvils, cannon balls and similar items.

Development of the stove played a major role in the acceptance of cast iron, and before 1800 stove-making had become the "most extensive, superb and profitable manufactures" in Europe and America.

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Lawrence J. Andres, president, Wisconsin Chapter, AFS, and Lawran Foundry Co., Milwaukee, pours aluminum commemorative plaque in front of Schroeder Hotel, Milwaukee

25th Chapter Anniversary Marked at

WISCONSIN CONFERENCE

By W. G. GUDE, EDWIN BREMER, and ERLE F. ROSS

● MOST SEVERE weather of the winter had little effect on attendance at the 23rd annual Wisconsin Regional Foundry Conference. Well over 600 foundrymen registered for the two-day meeting at Milwaukee, Feb. 11-12, as the Wisconsin Chapter, AFS, marked the 25th anniversary year of its founding. The University of Wisconsin co-sponsored the conference.

Twenty separate technical sessions and three general meetings were included in the program, in addition to two luncheons and the conference banquet.

Discussing the recent steel strike, Harold J. Ruttenberg, banquet speaker, said that it marked the end of a period in which wage increases were granted freely, followed automatically by higher prices to offset the higher costs. From now on, higher wages must be based on improved productivity because it no longer is possible to pass along wage settlements in the form of higher prices without regard to the economics involved.

Mr. Ruttenberg, former official of the United Steel Workers union, feels that the union won the battle in the 116-day strike but lost the war. He said the labor leaders recognize that the era of wage productivity bargaining is here, even though they fought this concept with some success in the strike.

John Varga, Battelle Memorial Institute, Columbus, Ohio, also spoke at the banquet He discussed briefly his observations of recent developments in the European foundry industry.

Luncheon speaker the first day was Rev. T. Parry Jones, pastor, First Methodist Church, Sheboygan, Wis., on the subject "High-Pressure Living." Speaking at the second day's luncheon, Dr. Paul J. Mundie, management consultant, stressed the need for industry to pay more attention to the development of individuals rather than to concentrate solely on improvements in technology.

In his welcoming address at the conference opening, Kurt F. Wendt, dean, College of Engineering, University of Wisconsin, Madison, Wis., emphasized that now, more than ever before, industry-college cooperation is essential for mutual survival. There is a tremendous acceleration in the pace of new developments. Foundrymen certainly see this in their own business, the speaker ventured. In all probability, 75 per cent of the products foundries manufacture or sell are based on developments which were new during the last 15 years.

To industry, Dean Wendt directed the admonition: "You must stay

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abreast of new knowledge, new products, and changing conditions to stay in business. You must provide for the increasing population."

The job which engineering schools must do, he said, includes building adequate facilities and faculty staffs, providing appropriate adult education, revamping of curriculums, developing of new and improved teaching procedures, and responding more fully to the needs of underdeveloped countries through the State Department.

"Opportunities and Problems for the AFS" was the topic discussed by Norman F. Dunbeck, vice president, International Minerals & Chemical Corp., Skokie, Ill., and national vice president of the AFS. He emphasized the need for the foundry industry to engage in "forward thinking" and appealed for expanded research activities.

PATTERNS

Electroforming for Pattern Construction and Repair, by Phil Ritzenthaler, Plating Engineering Co., Milwaukee. Most promising use for electroforming, or electrodeposition of metals, is in making original patterns. It is useful in making duplicates, also for salvaging patterns which have become worn or require changes.

Electroforming is a cold process, consequently there is no warpage and close dimensions can be maintained. Nickel plating is performed at the rate of about 0.001 in. per hour and can be applied to almost any of the common pattern metals. Cladding of aluminum to improve wear is highly effective. A thickness of 0.005 in. of nickel is adequate and provides better release from the sand than does aluminum.

Wood or plaster are not good pattern materials for electroforming, both being affected by plating solutions. Plastics constitute a good material. Before plating, the pattern is coated with a metallizing spray which makes its surface a conductor for plating.

Patterns by the Shaw Process by Richard J. Christensen, Cast Masters Inc., Racine, Wis. The Shaw process is a precision casting process employing conventional patterns of wood, plastic, or metal. A refractory slurry is poured over the pattern in a flask. It hardens at a rate which is adjustable, and shortly before setting has a flexibility which helps pattern removal.

The mold next is torched to burn off volatile materials and then is baked at high temperature prior to pouring. Molds will accommodate metal temperatures up to 3300° F.

Advantages of the process are high dimensional accuracy of castings, lack of need for special types of patterns, and ability to produce larger castings than are practical with some other precision casting processes.

New Applications in Plastic Patternmaking by William Weaver, president, Modern Pattern & Plastics Co., Toledo, Ohio. Metal fibers are being introduced into plastics used in the high-temperature field. The high-temperature resins have relatively high strength. Through use of steel wool fibers originally, it was found possible to control shrinkage in high-temperature resins. Today, fibers of steel, aluminum, and brass are being employed. Guns are available for spraying epoxy resins and metal fibers.

Use of Low-Melt Metals in Constructing Matchplates by O. J. Seeds, Cerro De Pasco Sales Corp., New York. The making of aluminum matchplates requires a number of accurate duplicates of the original master wood pattern and the problem has been to find suitable casting alloys. Among disadvantages of the commonly used alloys are appreciable shrinkage, high melting and pouring temperatures and high cleaning costs.

Suitable nonshrinking metals include an alloy of 55.5 per cent bismuth and 44.5 per cent lead which has a melting temperature of 255° F, also several alternate alloys with melting temperatures as low as 158° F. Accurate duplication is assured. They cast well in sand, plaster, wood, or other materials.

Excellent duplicates of thin sections are claimed, since the metal is very fluid when molten and will flow into thinner sections than other pattern metals if proper pouring temperature is used. Melting and pouring temperatures are only about half those of other casting materials.

Runners can be cast integral with the pattern and easily soldered to the brass gate, and patterns are ready for use a few minutes after pouring. After low-melting alloy patterns have served their purpose, the metal can be melted for reuse. These metals also can be sprayed to form a light coating on wood patterns.

STEEL

Dow 230 Process by Carl Baumgartner, Crucible Steel Casting Co., Milwaukee. This sand additive, a synthetic polymer, has been used

Finished plaques with gates and runners are looked over. From left, Mr. Andres; Bradley Booth, vice president, Wisconsin Chapter, AFS; and Charles Crabb, Industrial Division, Milwaukee Association of Commerce

by the foundry as a cereal replacement for more than a year in quantities ranging from 4 to 12 ounces per ton of sand.

Advantages reported for the material are the following: Enhanced dry shear and wet strengths, improved flowability, easier ramming and tucking, cleaner mills and chutes, increased mold hardness, a 10 per cent increase in molders' productivity, improved shakeout and peel, better dimensional stability of castings, and more efficient wet sand reclamation.

A typical sand mixture includes 2500 lb reclaimed sand, 123 lb western bentonite, 9 lb plastic fireclay, 1 lb No. 230, 1¼ lb tetrasodium pyrophosphate, 3 per cent moisture. Mulling time is 4 minutes—1½ minutes dry and 2½ wet.

Natural Gas Cutting was discussed by a panel composed of Robert L. Lacy, Victor Equipment Co., Chicago; Raymond O. Fish, Harnischfeger Corp., Milwaukee, and Robert F. Laughrin, Falk Corp., Milwaukee. Use of natural gas as fuel in oxygas cutting operations is not a cure-all. In some cases it functions equally as well and is as fast as oxyacetylene while in others cutting action is slower. In general the operational costs with natural gas are appreciably lower.

Due to differences in available pressures of the gases, the hoses for natural gas must have a cross-sectional area three times that for acetylene gas. Injector or inspiration type burners or torches may be used. Flames created by natural gas appear less intense than those for acetylene. It was stated that use of natural gas as a cutting fuel gives cleaner cuts, smoother kerfs, less slag.

GRAY IRON

High-Strength Molding Sands for the Jobbing Shop by Victor Rowell, Archer-Daniels-Midland Co., Cleveland. The best green sand castings are made in a sand having high green strength, low moisture, reasonable fineness when available, and a flowability plus good inherent thermo-stability when the sand is rammed very hard.

Plastic clays such as the bentonites plus adequate mulling will produce a high strength type of sand, but moisture must be held fairly low. High clay contents tend to broaden slightly the permissible moisture range and resist excessive drying out. The sand should be worked as closely to the brittle side as possible.

It is interesting to think in terms of ratio of green to dry compressive strengths. The most successful sands from a standpoint of casting quality are those with a ratio of one to four or five.

Heat Treatment of Gray Iron and Ductile Iron by P. H. Dirom Jr., Lynchburg Foundry Co., Lynchburg, Va. Types of heat treatment practiced by this foundry include stress relieving (1050° F), higher-temperature stress relieving (1150-1200°), low-temperature annealing (1250-1450°), high-temperature annealing (1650° F), normalizing (air cooling from 1650-1450° F), and quenching in oil and tempering.

Stress relieving is the most widely used treatment. It removes internal stresses and also improves uniformity of hardness in alloy iron castings. Low-temperature annealing

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is used for ductile iron castings which contain no carbides (cementite) as cast. High-temperature annealing is used for castings containing carbides as cast. Normalizing, used only with ductile iron, is intended to produce a structure of 70-80 per cent pearlite in castings containing an excessive amount of cementite or ferrite as cast. Quenching and tempering is performed on castings to produce a desired structure and hardness.

Factors involved in control of quality in production of gray iron and ductile iron castings were discussed by T. W. Curry, Lynchburg Foundry Co.

The Gas Fired Cupola by Carl R. Loper Jr., University of Wisconsin, Madison, Wis. Using a small cupola 6 in. ID, with cast iron inspiration-type gas burners located at the usual tuyere level, experiments were conducted to determine the practicability of using gas as fuel. The bed to support charges in the cupola was coke.

It was found that this arrangement resulted in highly reducing conditions in the cupola, and that the melting rate was only about 65 per cent that for normal coke operation. Graphite blocks were substituted for the coke bed with the same results.

Then the bed was constructed of 1½-in. firebrick blocks supported on a central refractory column. It resulted in a tendency for the metal in the charges to fuse together and cause bridging. To control that problem a thin layer of coke was placed on top of the refractory bed, and the metal charges were separated by coke in the ratio of 1 coke to 27 iron. With that arrangement melting rates of nearly 5¼ lb per minute or 11 per cent greater than expected for coke-firing, were obtained, and the metal temperatures ranged from 2750 to 2800° F.

NONFERROUS

Opening technical nonferrous session was a panel discussion on **Problems of Aluminum Permanent Molding.** Panel members were Merlin Rostad, Rostad Aluminum Corp., Grafton, Wis.; Edward Troy, Est Co., Grafton, Wis., and William Eckert, Meta-Mold Corp., Cedarburg, Wis.

The speakers indicated that with aluminum alloys, wall thicknesses as low as 0.100 in. could be obtained, but with magnesium alloys the minimum is 0.150 in. All agreed that coating the mold face is important in securing satisfactory castings. The mold face cannot be too smooth or the metal will not lie against it, and proper coating provides sufficient roughness to overcome that problem.

With thin-wall castings, the surface is somewhat rougher than with heavier walls. Multiple gating with the gates arranged to eliminate hot spots provides uniform flow into the mold cavity and sound castings.

Aluminum Risering, Feeding, Degassing and Grain Refinement by Michael Bock II, Exomet Inc., Conneaut, Ohio. Quality of aluminum castings is impaired principally by these conditions: 1. Interdendritic porosity resulting from presence of hydrogen or from freezing during mushy type solidification. 2. Weak or brittle material present in grain boundaries. 3. Improper chemistry or heat treatment. 5. Poor grain size.

Degassing methods to control hydrogen in the metal and refining techniques for controlling grain size must be adopted where indicated. While exothermic materials can improve riser efficiency, their use with aluminum castings is limited since gas can be introduced into the riser and often into the casting. Excessive heat also can produce abnormally large grain structure.

In many cases, instead of thickening the sections and overdesigning, physical properties of the casting can meet requirements by judicious use of chills and insulated risers, assuming that the metal is free of gas and has the proper grain structure.

CO_2 Practice by W. R. Oakley, Delhi Foundry Sand Co., Cincinnati. In one gray iron foundry the core sand mixture consists of 300 lb silica sand of 80 AFS fineness, 8 lb proprietary sodium silicate, 3 lb pitch, and 4 lb dextrin-type binder. The boxes are rapped before gassing, and the cores preferably are undergassed rather than overgassed. Cores are dip-coated in a volatile-vehicle mixture, lighted-off, and placed in storage.

In a large nonferrous foundry the sand consists of 70 to 80 per cent

reclaimed sand of 120 AFS grain fineness and a bank sand of 150 fineness and 2 per cent clay content. In addition to the sodium silicate, 1 per cent sand conditioner or kerosene and 1 to 1½ per cent fly-ash are added. The fly-ash, added after the silicate has been mixed in, prevents drying out of the sand.

Molds are produced on blow-squeeze machines at the rate of 700 per day. Gassing depends on sand thickness and ranges from 5 seconds for ¾ in. thickness to 10 seconds for 2 in. thickness.

Practices in a third foundry producing gray iron castings described by Mr. Oakley are given in detail in the article "Pouring Ungassed Sodium Silicate-Bonded Molds" by W. G. Probst III and Gerald R. Scott which appeared in the March issue of FOUNDRY.

Copper Base Foundry Problems by R. A. Colton, Federated Metals Div., American Smelting & Refining Co., Houston. Recommended practice for brass foundry operation was discussed, including melting, pouring, and gate design.

MALLEABLE IRON

Shell Core Sand by Frank Less, Durez Plastics Div., Hooker Chemical Corp., North Tonawanda, N. Y. Mulling time in the coating of shell sands varies, but mulling should not be prolonged once maximum strength is reached, otherwise some of the resin coating will be removed. Two minutes for hot coating and 15 for cold coating are average mulling times.

High strength in coated sands is promoted by high density, and a smooth coating of resin causes good packing. Density as well as strength should be checked. Type of wax used in the sand mixture affects compaction although the time of its addition is not important. About 5 per cent wax gives the best lubrication of coreboxes. Hexa accelerator provides maximum hot strength (at 460° F) with a 14 per cent addition. Hot strength also rises with curing time of up to 3 minutes, dropping with longer curing.

Sand Control and Casting Quality by Joseph S. Schumacher, Hill & Griffith Co., Cincinnati. Because of the wide variations developed in castings as a result of slight changes in moisture content, molding methods must be watched constantly. Also, sand laboratory test work should be done not only on the standard AFS procedure but also at the levels the sand actually is used in the foundry.

By developing physical property curves for green strength, green shear, permeability, and dry strength as compared to mold hardness variations, we can tell with a simple mold hardness test at the molding line what to expect from a given mold on a given casting. This is the point where quality is made.

Introduction and Administration of Standards by Robert D. Wills, Stevenson, Jordan & Harrison Inc., Chicago. Before standards are measured and introduced, methods must be analyzed and standardized. A work simplification program should be introduced to the industrial engineers and foremen to establish the best methods. Setting up the standard requires suitable forms describing the job specification, standard method of doing operation, and means for calculating the standard in a systematic manner.

Foremen and some operators must be trained in performing the operation in accordance with the established method. Final step before actual introduction of standards is an orientation meeting of employees, foremen, and engineers where details in written form are explained so that there is complete understanding by all concerned.

The industrial engineering department should have the continuing responsibility for cost reduction. It should be on constant lookout for methods improvement—in workplace methods, material handling, new equipment and new techniques. As those changes are introduced, the standards must be revised to reflect them. Standard data must be reworked constantly if cost reduction is to keep up with methods improvement.

Air Furnace Operation by Andrew Kavosi Jr., Auto Specialties Mfg. Co. (Canada) Ltd., Windsor, Ont. Details of construction of two types of air furnaces at the speaker's plant were described. Practice is to charge within 1 ton of the amount of metal required to pour off the molds to be set out for the day's one heat.

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Sold by many leading distributors of foundry supplies from coast to coast.

Circle 648 on Page 53

MALLEABRASIVE

News Views

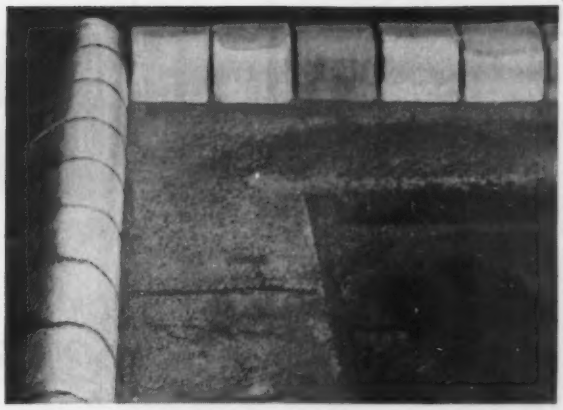
10-YEAR CELEBRATIONS: Alloy Steel Castings Co., Southampton, Pa., recently celebrated its first decade by honoring two employees with 10-year service awards. Molder John Varga, left, and Donald Volk, center, president, receive awards from Edgar Rulon, vice president, Fischer & Porter Co., Warminster, Pa., the parent company

POWER UNIT: Allis-Chalmers Mfg. Co., Milwaukee, has shipped the fourth of 12 reversible pump-turbines to be supplied to Tuscarora Pump & Power Plant, Niagara Falls, N. Y. Each unit, among the largest ever built, is rated 28,000 hp under a 75-ft net head as a turbine, to deliver 3400 cfs against a dynamic head of 85 ft as a pump. This 50-ton runner was fabricated by welding the carbon steel cast buckets to a cast crown and runner band

IN OPERATION: Linde Co., division of Union Carbide Corp., has installed a liquid oxygen storage and distribution system at Capitol Foundry Div., National Malleable & Steel Castings Co., Phoenix, Ariz. Shown, left to right, are G. A. Fisher, chief metallurgist, and Paul Zavala, furnace operator of Capitol, and G. M. Quinn of Linde Co.

PRIZE SALESMAN: Frank G. Atkinson, right, president, Joseph Dixon Crucible Co., presents the President's Award, an engraved wrist watch, to Roy H. Helge for being named salesman of the year of the company's industrial division

B&W Kaocrete-D, vibrated in place, provides high resistance to the atmospheres encountered in this coke oven door installation. Furthermore, the high erosion resistance and long service life without loss of strength of B&W Kaocrete-D add to its suitability in this application.



A typical monolithic curb wall construction in an annealing furnace using a carbon monoxide atmosphere. The greatly reduced number of joints in which sealing sand can penetrate prevents structural spalling of B&W Kaocrete-A upon heating and cooling. Being monolithic, gas leaks are practically eliminated.

A radiant tube annealing furnace with a base of Kaocrete-A, backed up with Kaolite-20, one of B&W's insulating refractory castables. This furnace operates at approximately 1700 F in a 65% CO atmosphere.

A stack annealing furnace with pedestals cast of B&W Kaocrete-A. The atmosphere is slightly above 8% CO. B&W Kaocrete-A offers strength, volume stability and resistance to carbon monoxide disintegration.

How B&W refractory castables perform in atmosphere applications

One of the difficult problems facing furnace builders and operators in the metals industries is the effect of atmospheres on refractory linings. That's why B&W offers several *specialized* refractory castables for this service, each possessing strength, volume stability and the refractoriness necessary to assure long, trouble-free service.

Take B&W Kaocrete-A, for example. Because of the careful selection and processing of special aggregates and other ingredients with low iron content, this material resists disintegration or other effects produced by high concentrations of CO or H_2 atmospheres. B&W Kaocast and Kaocrete-32 provide the same excellent service at higher temperatures while lightweight Kaolite-20 is outstanding as an insulating castable in atmosphere applications.

B&W Bulletin R-35A gives additional information on versatile B&W refractory castables. Write for your copy of this bulletin to The Babcock & Wilcox Company, 161 East 42nd Street, New York 17, N. Y.

R832

B&W

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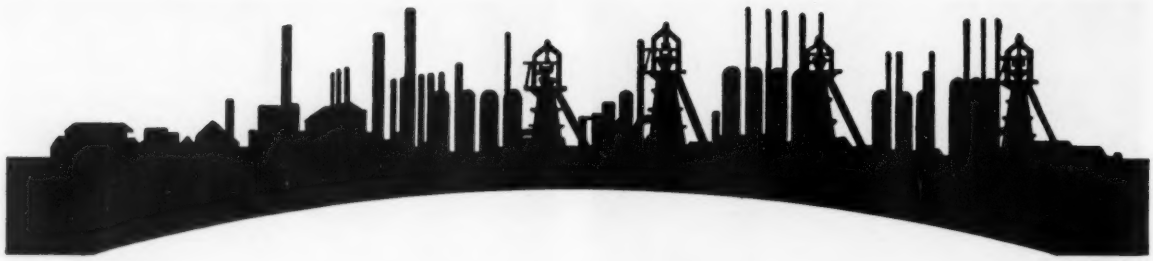
REFRACTORIES DIVISION

B&W Firebrick, Insulating Firebrick, and Refractory Castables, Plastics, Ramming Mixes, Mortars, and Ceramic Fiber.



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Our Company—a versatile producer of a wide range of quality pig irons—captures its own raw materials within nine miles of its furnaces and ovens . . . hauls them on its own rails . . . processes them into a wide variety of analyses equalled by no other similar operation. It produces pig iron within these limits of analyses:

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Sulphur under .05%
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HICKMAN, WILLIAMS & COMPANY with Sales Branches at—

609 Bona Allen Building, Atlanta 3, Ga.; 230 North Michigan Avenue, Chicago 1, Ill.; First National Building, P. O. Box 538, Cincinnati 1, Ohio; 1659 Union Commerce Building, Cleveland 14, Ohio; 1203 Ford Bldg., Detroit 26, Mich.; P. O. Box 335, Duluth 1, Minn.; 412 Guaranty Bldg., Indianapolis 4, Ind.; 70 Pine St., New York 5, N. Y.; 1500 Walnut Street Bldg., Philadelphia 2, Pa.; 1910 Clark Bldg., Pittsburgh 22, Pa.; 902 Syndicate Trust Bldg., St. Louis 1, Mo.

WOODWARD IRON COMPANY

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Men of Industry

DR. WALTER R. HIBBARD JR.
. . . research dept. mgr.

STOWELL C. WASSON
. . . retires as staff v. p.

ROGER W. GRISWOLD JR.
. . . Erie Malleable pres.

MARTIN F. SCHEIDER
. . . becomes foundry mgr.

Dr. Walter R. Hibbard Jr., formerly manager of the alloy studies section, Metallurgy and Ceramics Research Department, General Electric Research Laboratory, Schenectady, N. Y., has been appointed manager of the department. He is vice president and a director of the American Institute of Mining, Metallurgical and Petroleum Engineers, and a past president of the Metallurgical Society.

Edwin C. Barringer, since 1938 executive vice president, Institute of Scrap Iron and Steel, Washington, will retire this month.

Chester Otto has been made general foundry foreman, Vilter Mfg. Co., Milwaukee. He joined the company in 1946.

Dr. Ralph A. Schaefer, director of research and development, Bunting Brass & Bronze Co., Toledo, Ohio, has been named director of an enlarged department which will include research development, processing engineering, and inspection functions. **David C. Spaulding**, manager of product engineering, has been appointed assistant director.

Roy G. Heckenkamp has been named treasurer and office manager, Carondelet Foundry Co., St. Louis. He will continue as assistant secretary.

Stowell C. Wasson has retired as staff vice president, National Malleable & Steel Castings Co., Cleveland. He will continue as a director. Mr. Wasson joined National in 1911 and advanced from Indianapolis sales manager to manager of the company works there. Later he managed the Chicago and Melrose Park operations, became a company director in 1947, and in 1954 was made vice president of plant operations with headquarters in Cleveland. Mr. Wasson was one of the founders and a past president of Foundry Educational Foundation, and is a former director of the American Foundrymen's Society. He will reside in Tryon, N. C.

Roger W. Griswold Jr., formerly factory manager, has been made president and general manager, Erie Malleable Iron Co., Erie, Pa., succeeding **P. H. Vincent**, who has become board chairman. **B. H. Scott**, general sales manager, has been named vice president of sales. Mr. Griswold joined the company in 1949 as superintendent of the foundry division. He was one of the organizers and first chairman of the Northwestern Pennsylvania Chapter of the AFS.

Arthur J. Frank has been named assistant to the president, and **Richard Seaman**, manager of commercial development, Chain Belt Co., Milwaukee.

Martin F. Scheider has been appointed foundry manager, White Diesel Engine Div., White Motor Co., Springfield, Ohio. Previous connections include Lunkenheimer Co. and the former A. R. Posey Co., Cincinnati.

Hiram Brown, formerly technical advisor to the vice president and general manager of Solar Aircraft Corp.'s Des Moines, Iowa, plant, has been named consultant to the department of metallurgy, Battelle Memorial Institute, Columbus, Ohio. Previous connections include Aluminum Industries Inc., Cincinnati, Frontier Bronze Corp., Niagara Falls, N. Y., and Aluminum Co. of America, Pittsburgh.

J. Howard Dunn has been named manager of the process development laboratories, Aluminum Co. of America, New Kensington, Pa. Since 1953 he has been manager of the Cleveland sales development division.

S. Eugene Weed has been named director of research and development, Vesuvius Crucible Co., Swissvale, Pa., succeeding **Charles A. Styer**, who has retired.

George H. Bodeen has been appointed general sales manager, Lindberg Steel Treating Co., Chicago. He is also project manager of the rocket and missile depart-

ROBERT F. STEWART

WILLIAM E. ARCHER

. . . Joy Mfg. Co. promotions

PAUL D. TERRIEN

DONALD J. PALMISANO

. . . Great Lakes Carbon appointments

ment. **Stanley Skozek**, office manager, has also been named assistant secretary. **Ronald F. Steward** recently joined the metallurgical staff of the Melrose Park, Ill., plant.

Robert F. Stewart has been named vice president and assistant general manager, and **William E. Archer**, manager of research and development, Western Precipitation Div., Joy Mfg. Co., Los Angeles. Mr. Stewart was formerly vice president-sales for the division's dust collecting equipment. Mr. Archer has been chief development engineer.

Malcolm M. Maynes has been appointed chief sales engineer of abrasives, Norton Co., Worcester, Mass. He joined the company in 1937.

William M. Grimes, formerly vice president, has been named president, Gartland Foundry Co., Terre Haute, Ind. **R. S. Hodler** has been made vice president and general manager.

William D. Walther, technical director, Dayton Steel Foundry Co., Dayton, Ohio, has been named president of Dayton Automotive Products Co., its new subsidiary. Other officers are: **George Walther Jr.**, vice president; **Eugene M. Mitchell**, vice president-sales; **Harold Melia**, secretary; and **Norman Burger**, treasurer.

C. H. **Glasier**, vice president-gases, has been appointed executive vice president, Air Reduction Sales Co., New York. He joined Airco in 1936.

Allen J. Reinert has been appointed eastern division sales manager, with headquarters in Philadelphia, for Conveyor Div., American MonoRail Co., Euclid, Ohio. **David A. Bollinger** has succeeded Mr. Reinert as Philadelphia district manager. **Owen E. Grady** has been named Los Angeles district manager. **George S. Fell** and **Jack Karcher** have been made Cleveland district sales engineers.

Paul D. Terrien has been appointed midwest sales representative, Electrode Div., Great Lakes Carbon Corp., New York. He formerly represented the company in Pittsburgh. **Donald J. Palmisano**, Kansas City sales representative, has been named sales engineer of specialties there for the division.

Roy W. Olsen has been appointed western sales manager, and **C. P. Vogel**, eastern sales manager, Alloy Metal Abrasive Co., Ann Arbor, Mich. Mr. Olsen will cover western states including Texas and Louisiana, with headquarters in Chicago. Mr. Vogel, in Ann Arbor, will handle sales in eastern and southern midwest states.

H. B. Jorgensen has been appointed supervisor of the sales training section, the Carborundum Co., Niagara Falls, N. Y. **P. R. Junod** and **E. A. Japely** have been named district sales managers in Philadelphia, and Area A, Chicago, respectively. The following sales appointments

WILLIAM M. GRIMES

R. S. HODLER

. . . Gartland Foundry executives

ROY W. OLSEN

C. P. VOGEL

. . . become sales managers

Save coke . . . melt hotter iron . . . Hot Blast will do this for you! Whiting Hot Blast gets more heat out of coke . . . ignites it faster. Tuyeres keep clean and unobstructed, provide better control of melt. Oxidizing zone is reduced and oxidation losses are cut. And less coke means less sulphur in the melt!

Hot Blast more than pays for itself in *coke savings alone!* Better quality, hotter iron are bonus benefits. Investigate Hot Blast now. Call in a Whiting Foundry Engineer!

FREE BOOKLET . . . Gives sharp insight into Hot Blast advantages; describes operation of two major types. Write for Bulletin FO-3. *Whiting Corporation, 15607 Lathrop Avenue, Harvey, Illinois*

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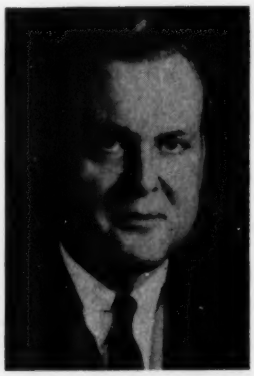
MANUFACTURERS OF CRANES; TRAMBEAM HANDLING SYSTEMS; TRACKMOBILES; FOUNDRY, RAILROAD, AND SWENSON CHEMICAL EQUIPMENT

Circle 671 on Page 53

EMIL J. ROMANS
. . . joins Canton Malleable

RAYMOND KRAUS
. . . engineering v. p.

RALPH E. ANDERSON
. . . joins Brillion Iron



THOMAS T. LLOYD
. . . becomes mfg. v. p.

have been announced: **M. F. Jenkins**, central Indiana; **H. Porth**, Indianapolis; **R. R. Kerrigan**, Rockford, Ill.; **K. W. Martin**, Syracuse, N. Y.; **W. W. Spiller**, Buffalo; **J. H. Jones**, Arizona; **G. S. Schroyer**, Salt Lake City, Utah.

Emil J. Romans recently joined Canton Malleable Iron Co., Canton, Ohio, as foundry manager. Mr. Romans has, since 1958, been foundry superintendent, National Malleable & Steel Castings Co., Cleveland, which he joined in 1933. He became supervisor of molders and labor, and in 1949 was made assistant foundry superintendent. Mr. Romans was chairman of the Northeastern Ohio Chapter of the American Foundrymen's Society in 1958-59.

William E. Karry has joined Bay City Electric Steel Casting Co., Bay City, Mich., as sales manager. Recently he was with West Michigan Steel Foundry Co., Muskegon, Mich., in a similar capacity. Former connections include Columbia Steel Co., Pittsburg, Calif., and Division Lead Co., Chicago.

Raymond Kraus has been appointed vice president in charge of engineering, Lester Castings Inc., Bedford, Ohio. Prior to joining the company in 1958 he was with Skil Inc., Chicago, and National Malleable & Steel Castings Co., Cleveland.

Ralph E. Anderson, formerly project manager (research metallurgist) for Owens-Corning Fiberglas Corp., Newark, Ohio, has joined Brillion Iron Works Inc., Brillion, Wis., as chief metallurgist.

Bruce C. Knapp, formerly with Bridgeport Brass Co., Bridgeport, Conn., recently joined Alloy Metal Abrasive Co., Ann Arbor, Mich., as chief metallurgist.

Howard G. Monroe has been named assistant sales manager, Baroid Chemicals Inc., Houston. He will assist in training of company sales engineers and retain responsibility for sales in Ohio, Michigan, and Indiana.

Thomas T. Lloyd has been appointed vice president, manufacturing, Albion Malleable Iron Co., in charge of operations at Albion, Mich., and the recently acquired Muncie, Ind., division. **Frank V. Jasienski**, formerly operations manager at Albion, becomes Muncie plant manager. **Donald I. Huisenga**, Albion foundry superintendent, has been made Muncie plant superintendent, and **James L. Snyder**, controller. Albion plant appointments include **Richard H. Dobbins**, plant manager; **C. Russell Baker**, chief engineer; **Roland H. Behling**, design engineer; and **Wendall D. Dickmeyer**, plant superintendent.

William N. Brammer has been appointed vice president-marketing, Precision Casting Co., to head sales, merchandising, and advertising at

WILLIAM E. KARRY
. . . joins Bay City Electric

BRUCE C. KNAPP
. . . joins Alloy Metal Abrasive

HOWARD G. MONROE
. . . assistant sales mgr.

WILLIAM N. BRAMMER
. . . Precision Casting v. p.

Plant Superintendent, W. C. Lauer, on the right, has to machine castings made by Foundry Foreman, Leonard Lintzenich. If castings aren't right, Lintzenich hears from Lauer.

"Cities Service Delco Core Oil makes our own castings easy to live with"

Schnacke Mfg. Corp., Evansville, Ind. produces a large variety of parts and assemblies for industry, which require all kinds of metalworking. As the company grew it found it needed more and more castings. To be assured of the quality castings they desired, it was decided to build and operate their own foundry. The foundry has grown so much, that it now produces castings for other manufacturers as well. The gray iron and steel castings range in size from a few ounces to over 4000 pounds. Most of them use cores.

A. E. Huffman, Assistant to the President, says, "Since most of our castings are simply brought across the yard to the machine shops, our foundry foreman, Leonard Lintzenich, has a tough job because he must live with what he produces." Lintzenich replies, "Our castings are actually easy to live with, thanks to Cities Service Delco Core Oil. I've tried many others and nothing tops Delco 54 for permeability and eliminating blows. In the past eight years I've found this one oil gives quality on all size cores, at the lowest cost per core." Also high in Mr. Lintzenich's praise are Cities Service liquid parting compound and Servcote core mold wash.

To find the perfect core oil for you, call your local Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, 20 North Wacker Drive, Chicago 6, Illinois.

Cities Service Delco 54 Core Oil produces perfect cores every time. It gives ideal permeability and eliminates blows in every type of core, from smallest to largest.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

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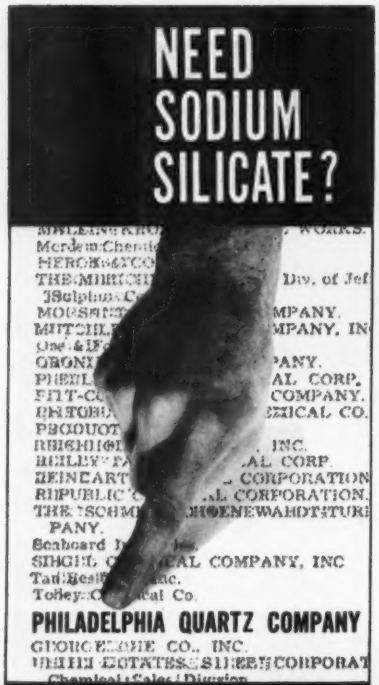
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PQ offers the widest selection of silicate products—over 30 solutions ranging in %Na2O:%SiO2 from 1:3.75 to 1:1.60 and 25 powders and solids, %Na2O:%SiO2 from 1:3.22 to 2:1.0.
Convenient availability coast to coast from plants located in Anderson, Ind.; Baltimore, Md.; Buffalo, N.Y.; Chester, Pa.; Jeffersonville, Ind.; Kansas City, Kan.; Rahway, N.J.; St. Louis, Mo.; Utica, Ill. and from associate companies: Philadelphia Quartz Company of California—Plants located in Berkeley and Los Angeles, Calif.; Tacoma, Wash. National Silicates Limited, with plants located in Toronto and Valleyfield, Canada.
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Circle 673 on Page 53

ELTON E. STAPLES
. . . Hevi-Duty Electric pres.

JAMES M. LANGE
. . . joins Chas. Taylor Sons

its Cleveland and Fayetteville, N. Y., plants. Former connections include Apex Smelting Co., Pressure Castings Inc., and Thompson Ramo Wooldridge Inc., Cleveland.

Elton E. Staples has been appointed president, Hevi-Duty Electric Co., Div. of Basic Products Corp., Milwaukee, succeeding **Harold E. Koch**, who will devote more time to duties as executive vice president of Basic Products and as president of Como-Cast Corp., a subsidiary. Mr. Staples has been Hevi-Duty general manager and has served as vice president-sales and sales manager of the company's Chicago district. He is a past president of the Industrial Heating Equipment Association.

Charles W. Dauer and **Robert E. Wilshek** have been named district sales managers for Miller Fluid Power Div., and Tru-Seal Div., Flick-Reedy Corp., Chicago. Mr. Dauer will manage various eastern and midwestern states, Quebec and Ontario. Mr. Wilshek, field engineer, will cover the western and southwestern area. **Emil Galandak**, sales engineer, has succeeded Mr. Dauer as chief sales engineer.

James M. Lange, former refractory engineer with Bethlehem Steel Co., Bethlehem, Pa., has joined Chas. Taylor Sons Co., as sales development engineer, with headquarters at the Cincinnati main office.

L. L. Warriner, management and engineering consultant, has been elected board chairman, Cooper-Bessemer, Mt. Vernon, Ohio, succeeding **L. F. Williams**, who will continue as a director and member of the executive committee, after 40 years with the company. **Grant C. Woodard**, general sales manager, and **Harold C. Johnson**, manager of manufacturing, were elected vice presidents. **E. L. Miller** is president.

O. Jay Myers, head of the Foundry Products Div., Reichhold Chemicals Inc., White Plains, N. Y., has

CHARLES W. DAUER

ROBERT E. WILSHEK

EMIL GALANDAK

. . . appointments at Flick-Reedy Corp.

G. C. CUSACK
. . . becomes division pres.

WILLIAM BUSBY
. . . Texas Foundries v. p.

JACK L. MARTIN
. . . joins Superior Foundry

also been appointed acting general manager of its new Varcum Chemical Div., Niagara Falls, N. Y.

G. C. Cusack, executive vice president, Pure Carbonic Co. Div. of Air Reduction Co., New York, has been named division president. Mr. Cusack succeeds **J. J. Lincoln Jr.,** who has been transferred to the executive staff of the parent company.

Stephen Frye, vice president, has been elected president of Sivyer Steel Casting Co., Milwaukee, succeeding **Martin A. Fladoes,** who has been president since 1941, and becomes board chairman. **Charles C. Means** has been named vice president-sales for the Milwaukee and Chicago plants. **Arthur J. Hickey** has succeeded Mr. Means as treasurer. **Arthur C. Tishacek,** has retired as vice president, works manager and a director, after 45 years with the company.

HUGH J. PUGSLEY, senior vice president, Swindell - Dressler Corp., Pittsburgh, elected vice president of the Industrial Heating Equipment Association, as reported in March

William Busby, since 1958 chief engineer, Texas Foundries Inc., Lufkin, Tex., has been elected a vice president. He joined the company 11 years ago as production engineer, and later became industrial engineering superintendent. Previously he was with Stevenson, Jordan & Harrison Inc., Chicago, where he was engineering supervisor.

Jack L. Martin, recently with Trundle Consultants Inc., Cleveland, has been named manufacturing engineering manager of Superior Foundry Inc., and its Allyne-Ryan Div., there. Former connections include Stevenson, Jordan & Harrison, Cleveland, and James B. Clow & Sons, Chicago. **Daniel J. Gentile** recently joined Superior Foundry as industrial engineer. He has been with Wellman Bronze & Aluminum Co., Cleveland.

Eugene L. Miller, president, Cooper-Bessemer Corp., Mt. Vernon, Ohio, has been elected president of the Diesel Engine Manufacturers' Association, Washington, succeeding **John N. MacKendrick,** Clark Bros. Co., Olean, N. Y. **George Steven,** Worthington Corp., Buffalo, and **William E. Butts,** General Metals Corp., Oakland, Calif., were elected vice presidents. **Robert L. Stanley,** Falls Church, Va., continues as executive secretary.

Ben R. Shipley, assistant sales manager, has been named sales manager, Vesuvius Crucible Co., Swissvale, Pa., succeeding **Crawford B. Murton,** who has become manager of marketing.

This hopper and your truck can cut handling costs 50%

It's a self-dumping hopper made for fast, efficient handling of wet or dry, hot or cold bulk materials, such as:

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Cullet . . . Hot Forgings
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They're strong . . . husky . . . made of 3/16" steel plate with continuous arc-welded seams. Also available in stainless steel or galvanized. Made in five sizes, ½ to 2 yard capacities, with live skids or a choice of wheels.

Standard models are available for immediate shipment from stock.

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HOPPER

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Circle 674 on Page 53

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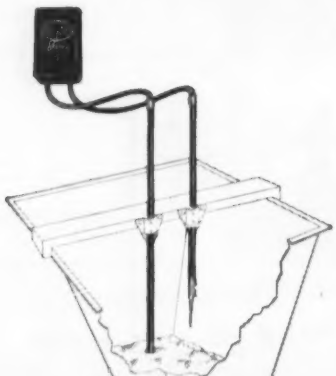

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How it works

Units Controlled	Hopper Empty Both Probes Uncovered	Sand Bin is Filling. Bottom Probe covered; Top Probe Uncovered	Hopper Full Both Probes Covered	Sand In Use Top Probe Uncovered; Bottom Probe Covered
Red Light	Off	Off	On	On
Green Light	On	On	Off	Off
Valve	Energized	Energized	De-Energized	De-Energized
Plow	Down	Down	Up	Up

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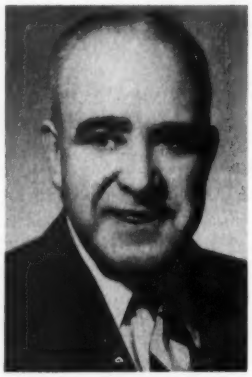
Circle 675 on Page 53

Obituary

James G. Goldie, 58, foundry instructor in the old Cleveland Trade School and the new Max S. Hayes Trade School until his retirement two years ago, died March 6. Mr. Goldie was born in Scotland and served his foundry apprenticeship with John Cochrane Ltd., Barrhead. He received technical training at Glasgow Technical College. In



JAMES G. GOLDIE

1923 he came to the United States and worked in several eastern foundries before taking charge of the Foundry Department, Connecticut State Trade School, Meriden. In 1929 he went to Cleveland to establish the foundry department of Cleveland Trade School. When the new Max S. Hayes Trade School was being built, he was placed in charge of planning and installing the new foundry laboratory. Mr. Goldie was president of the Northeastern Ohio Chapter of the AFS in 1943-44. He later was chairman of the Apprentice Training Committee of AFS, and has contributed articles to the technical press on foundry training.

Howard C. Waldron, 55, assistant works manager, Nordberg Mfg. Co., Milwaukee, died Feb. 27. He joined the company 32 years ago as chief metallurgist and had previously been foundry manager and superintendent.

Frank Valtier, 88, for about 25 years with Harry W. Dietert Co., Detroit, where he helped to produce practical sand testing equipment for foundry use, died Mar. 7, in Toledo, Ohio. A native of Strassburg, Germany, from 1887, when he arrived in New York, until 1929, when he joined the Dietert company, Mr. Valtier was with various companies as machinist and superintendent. He left GMC's Factory Production Section to join Dietert and from 1935-38 was in the experimental department of Nash-Kelvinator. He returned to the Dietert company in 1938 and retired in 1956.

John E. McCauley, 77, since 1954 board chairman and chief executive officer, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., died Feb. 28. He joined the company in 1910 as assistant general manager, became vice president and general manager in 1919, and president in 1934. Mr. McCauley was president of the Steel Founders' Society of America in 1929-30.

Frank Klatt, 73, former president of the W. W. Sly Mfg. Co., Cleveland, died Feb. 28, in Hollywood, Fla., where he had been living since he retired in 1954. He was general manager of the Sly company from 1921 to 1927, and for the following 12 years was managing director of General Motors Corp. in India. He rejoined Sly and became president in 1947.

Frank D. O'Neil, 58, sales representative for Allied Steel Castings Co., Harvey Ill., died Feb. 6 in Mobile, Ala., while on a vacation trip. Mr. O'Neil was vice president-treasurer of the former Western Foundry Co., Chicago, until 1954, when it was acquired by Ebaloy Inc., Rockford, Ill.

Edwin A. Watson, 76, from 1933 until his retirement in 1953 editor of the *Iron Worker*, a publication of the Lynchburg Foundry Co., Lynchburg, Va., died there Feb. 3.

Sidney J. Ross, 50, sales engineer in western New York, western Pennsylvania, and northeastern Ohio, for C. R. Daniels Inc., Daniels, Md., died Feb. 26.

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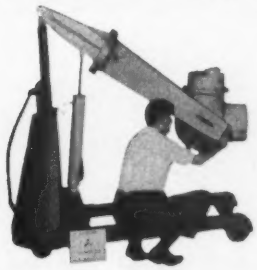

gets through 5" of steel in 5 minutes

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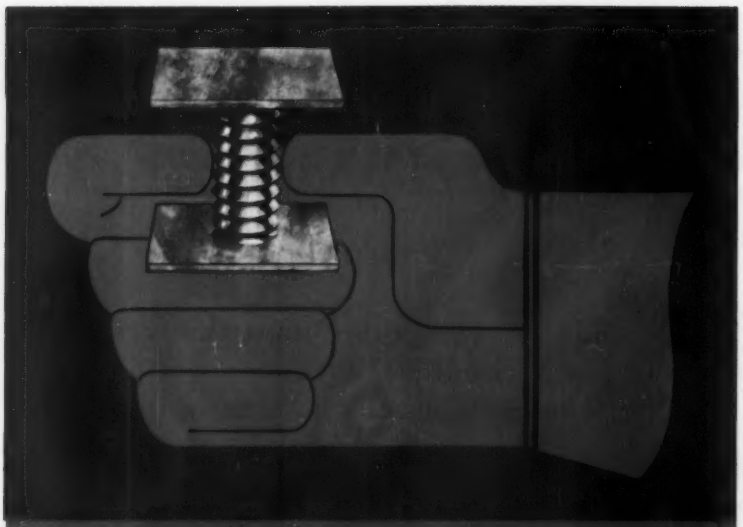
Circle 676 on Page 53



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PATENTS

Of Interest to Foundrymen

Determines Hardness

Automatic hardness checking and sorting installation applies steady load to a specimen through a suitable indenter. Actual strain is sensed by a strain sensing means providing an electrical signal. The signal is amplified and triggers a timing circuit adjusted to close an electronic gating circuit at the end of a fixed timing cycle. Amplitude of signal at the instant of closure of the gating circuit measures relative hardness of the material. The strain signal also passes into a sorting circuit to operate relays which classify materials into hardness groups. *Patent No. 2,912,105 granted to R. D. Allured and J. L. Walker and assigned to General Motors Corp.*

Ceramic Shell Mold

Improved refractory mold for precision casting of metals having high melting points and a method of making the mold is described in this patent. A frozen mercury pattern is used and successively dipped in four different liquid slurries to form a shell-like mold. Mercury then is

liquefied, drained from the mold, and the mold fired at 1850° F to obtain a hard smooth, porous ceramic mold which later is filled with molten metal.

The first slurry in which the frozen mercury pattern is dipped is composed of 0.75 per cent by weight of sodium fluoride, 0.25 per cent boric acid, 1.50 per cent polyvinyl acetate, 1.000 per cent ethyl cellulose, 0.50 per cent phenolformaldehyde resin and 96 per cent stabilized cubic zirconium oxide which are dispersed in Freon 22.

Second slurry is composed of 2 per cent monobasic ammonium phosphate, 1.7 per cent polyvinyl acetate-ethyl cellulose, 0.3 per cent phenol resin, 60 per cent zircon, and 36 per cent mullite-kyanite—dispersed in Freon 22. Third slurry is composed of 1.5 per cent polyvinyl acetate, 37.5 per cent aluminum silicate, and 62 per cent—dispersed in Freon.

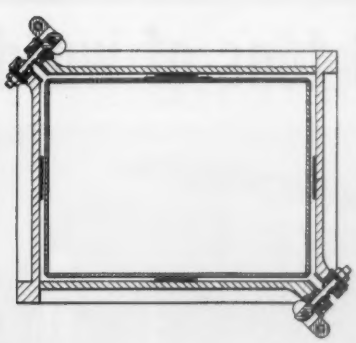
Fourth slurry is composed of 17.5 per cent zircon (325 mesh), 75 per cent zircon (coarse, unground particles), 1.5 per cent polyvinyl acetate, and 6 per cent sodium fluoride—dispersed in Freon. Coatings are about 1/16 in. thick. *Patent No. 2,912,729 granted to John M. Webb.*

Composition for Shell Molds

Method of making a shell molding composition by cold coating includes mixing 94 to 98 parts sand with 2 to 6 per cent stage A liquid phenol formaldehyde resin, 0.5 to 3 per cent novolak or lignin type resin and 0.5 to 2 per cent magnesium oxide with or without addition of 0.1 to 1.0 per cent hexamethylenetetramine. Waxes such as octadecenamide, paraffin, or carnauba in the amount of 0.05 to 0.2 per cent also may be included. *Patent No. 2,913,787 granted to R. H. Cooper and assigned to Dow Chemical Co.*

Holds Slip Band Tightly

Separable foundry flask, or slip flask as it commonly is called, is shown in the accompanying illustration. It contains an improved



means for holding an endless band member or slip jacket within the flask when it is in the locked position.

Holding or retaining means are

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Circle 679 on Page 53

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FOUNDRY DIVISION

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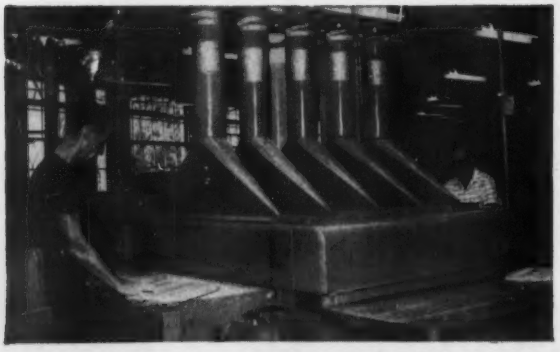
Circle 680 on Page 53

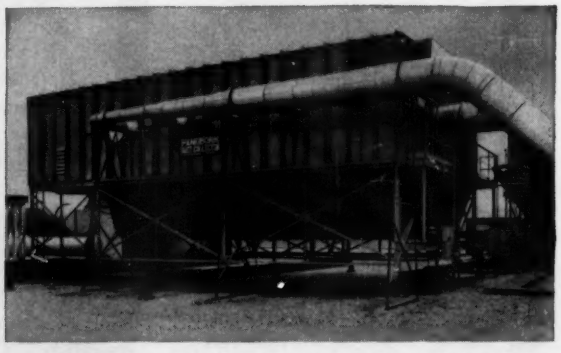
Operation: Dust Control

(One of a series)

At National Cash Register, 10 tons of wood



Dust is trapped at the source by hoods engineered for the individual job . . .



. . . and is piped from 160 locations to five giant Pangborn Cloth Bag Collectors.

shavings, chips and dust are collected daily!

Mammoth is the word for the 5-floor woodworking plant of National Cash Register headquarters, Dayton, Ohio. Processing nearly 300,000 sq. ft. of lumber each month, this operation generates 10 tons of waste material per day.

To protect NCR employees, equipment, plant and neighborhood, five Pangborn Cloth Bag Dust Collectors trap 90 cu. ft. of fine dust for disposal and, during the winter months, permit recirculating of the already-heated, cleaned air. This efficient performance of Pangborn Dust Control saves thousands of dollars in heating costs during the cold weather. In addition, a neighborhood and health nuisance has been eliminated; equipment maintenance and plant housekeeping costs have been minimized.

Dust a continuing problem in *your* plant? Talk to the Pangborn man in your area or write: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control, Blast Cleaning, Vibratory Equipment—Rotoblast® Steel Shot and Grit.®*

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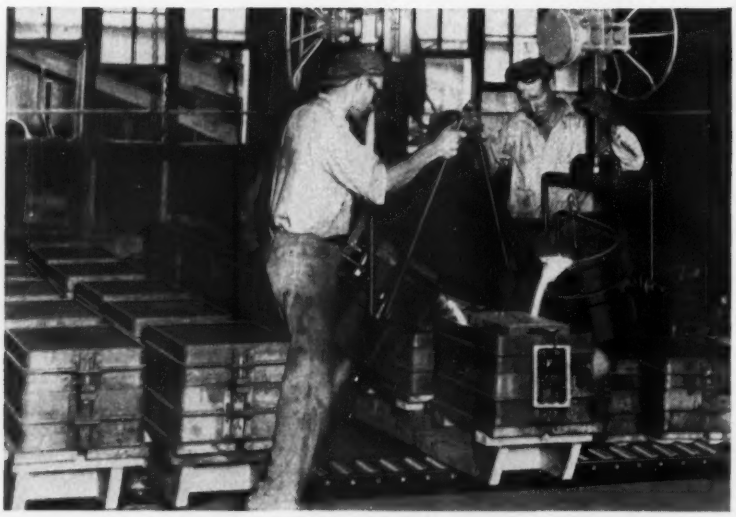
Circle 716 on Page 53

STANDARD'S SHIELDED BEARINGS

Grease-packed against dirt and corrosion—ideal for Foundry Conveyor Service



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Standard's bearings are specially engineered for heavy duty foundry service . . . protective shielding keeps dirt from entering bearing. They are grease-packed at the factory for added protection and minimum maintenance. Provision made for regreasing to flush bearings.

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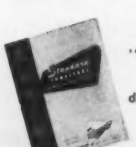

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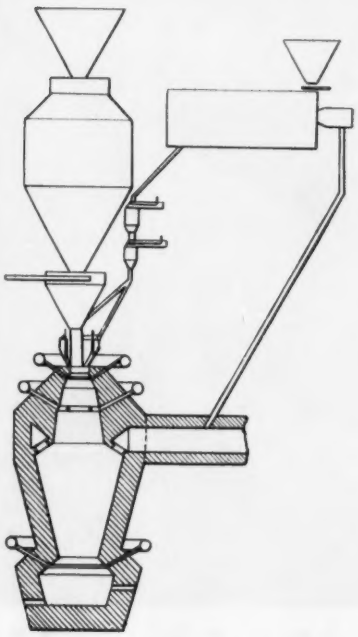
thin pads situated centrally in the upper portion of the flask on the sides and ends. They are designed to exert a slight inward pressure on slip jacket walls when the flask is locked, and hold the jacket firmly in place. After the flask and contained jacket are filled with sand, releasing the lock permits the jacket to resume its normal shape without distorting the sand. *Patent No. 2,915,796 granted to Russell J. Hines and assigned to Hines Flask Co.*

Serves Several Functions

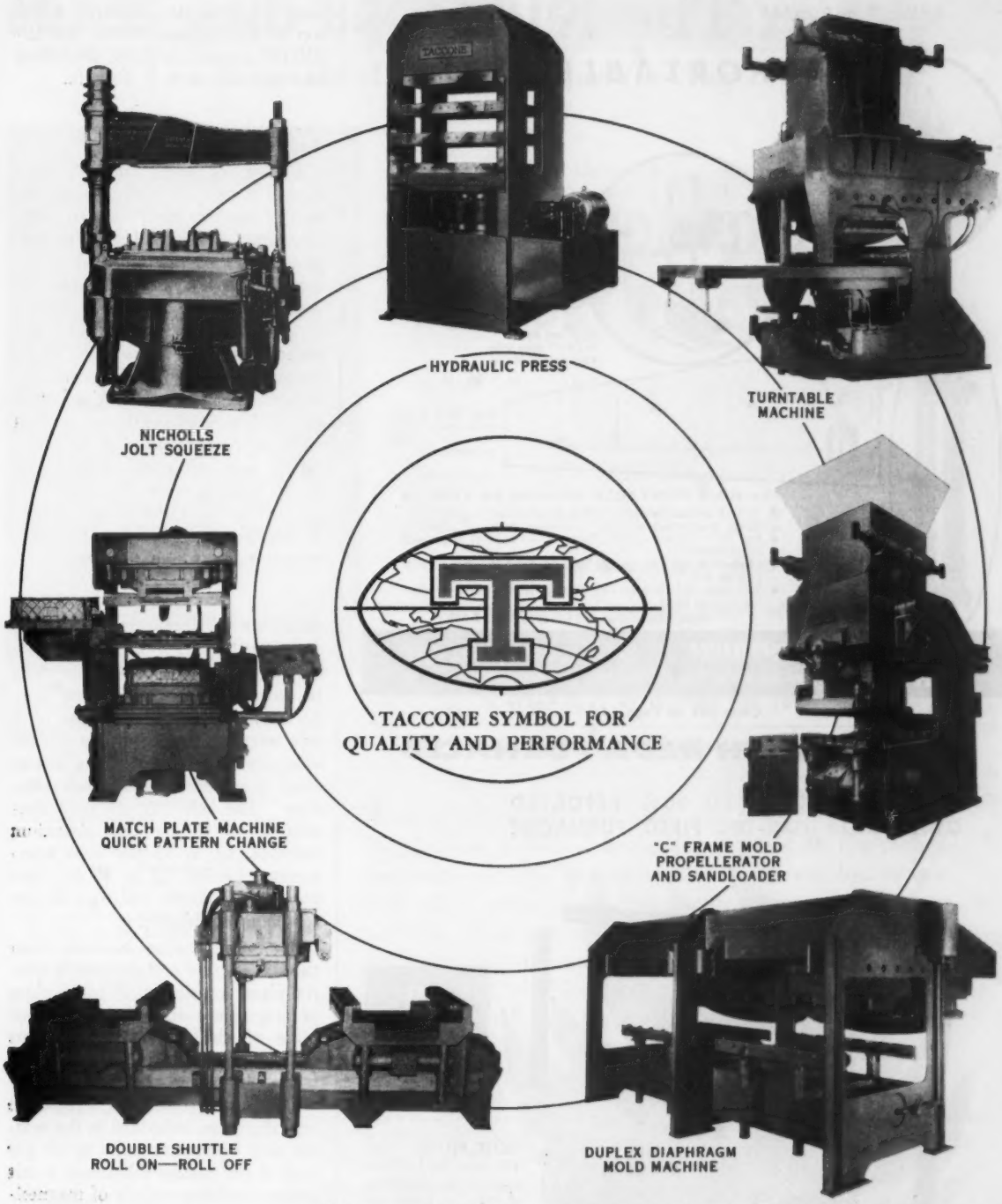
Gas-generating shaft furnace which can be operated as a gas generator, a blast furnace, or cupola is shown in the accompanying illustration. Two air inlets are in the top



section of the furnace and one at the bottom section. Gas takeoff is a short distance below the upper air inlets. Air is admitted through horizontal slots and obliquely into the chamber.

The coal fuel is stored in the hopper immediately above the furnace proper and fed into the center. The metal concentrates are dried in the oven at the right above, and fed through locks, annularly around the fuel.

When operated as a gas generator, about 85 per cent of the total air is admitted to the top of the furnace. When operated as a blast



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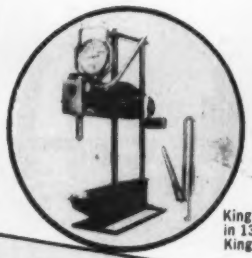

King Test Head in 13½" base with King Brinell Scope

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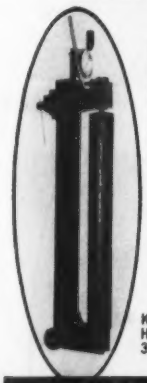

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Circle 682 on Page 53

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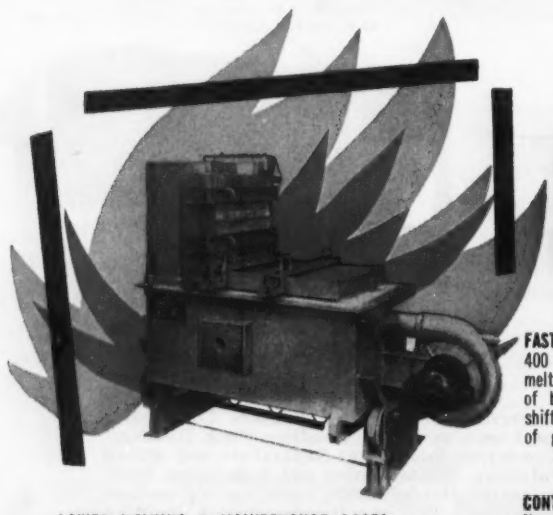

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Circle 683 on Page 53

furnace or cupola, only about 65 per cent of the air is admitted to the top of the furnace. *Patent No. 2,919,185 granted to N. R. Wahlberg and assigned to A. A. Severin.*

Bond for Sand Cores

Binder for stand cores is composed of one part linseed oil by weight and two parts resinous polymerization product. Latter is prepared from a steam-cracked petroleum fraction boiling between 80 and 350° F which is heat soaked at 220 to 240° F to dimerize the cyclic diemes. Dimerized cyclic dienes are separated from the undimerized materials, and the former are polymerized with a catalyst such as Attapulgus clay or phosphoric acid adsorbed on diatomaceous earth. *Patent No. 2,910,748 granted to Glen Porter and Clellie T. Steele and assigned to Esso Research & Engineering Co.*

Addition of Elements

Production of magnesium-base alloys containing controlled amounts of zirconium and manganese may be accomplished through use of a salt mixture containing the desired elements or by addition of a master alloy prepared from the salt mixture. The salt mixture may contain 33 to 45 per cent zirconium chloride, 12 to 33 per cent manganese chloride, 33 to 45 per cent potassium chloride and 0 to 20 per cent barium chloride.

The master alloy is made from the salt mixture and contains a matrix phase consisting of magnesium or magnesium alloyed with one or more of the permissible elements which represents 30 to 70 per cent by weight of the master alloy; metallic particles containing manganese and zirconium imbedded in the matrix and representing 20 to 60 per cent of the master alloy, and a salt phase consisting mainly of magnesium chloride with at least one alkali metal chloride and which will represent 1 to 20 per cent of the master alloy.

One example of the master alloy is that containing 44.5 per cent magnesium, 26.2 per cent zirconium and 11.8 per cent manganese. *Patent No. 2,919,190 granted to D. J. Whitehead and E. F. Emly and assigned to Magnesium Elektron Ltd.*

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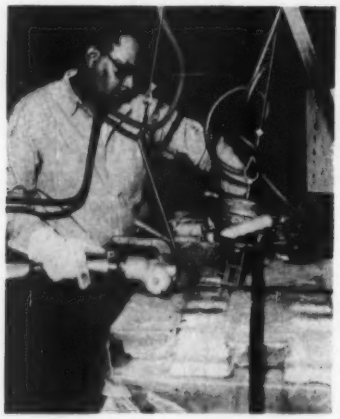
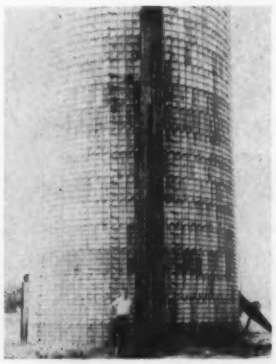


POLYETHYLENE BAG encases bundles of aluminum pig and ingot to keep out dirt and moisture during delivery to customers. The bags are used by Kaiser Aluminum & Chemical Corp. They are placed over the bundles and 1¼-in. steel straps are wrapped around the entire package and tightened with a pneumatic tool, as shown.

The wrapping was designed to allow air to circulate to prevent formation of condensation, and can withstand all normal transportation hazards. Customers can store the metal outdoors.

For More Details Circle No. 496—Page 53

Makes Pieces of Graphite 35 Feet Long



THESE 35-FT graphite pieces are said to be the longest ever manufactured on a commercial basis. The fine-grained, dense pieces were made by the Electrode Div., Great Lakes Carbon Corp., New York, and are 12⅛ x 12⅛ in.

The graphite was developed to meet requirements for molds which have exceptional strength at high temperatures. The manufacturer designed special equipment and handling devices to process shapes of such exceptional length.

For More Details Circle No. 497—Page 53

Adhesive Used to Tack Steel Facings to Wood

QUICK-SETTING ADHESIVE is being used at the Refractories Div., Carborundum Co., Keasby, N. J., to replace clamps in the assembly of steel facings to maplewood molds. The bonding agent, Eastman 910 Adhesive, is useful especially where surfaces to be faced are at odd angles, as shown.

Steel facing plate can be held in position after application of the adhesive and in a few minutes a bond forms. Within five minutes, the bond has sufficient strength to allow the moldmaker to drill through both

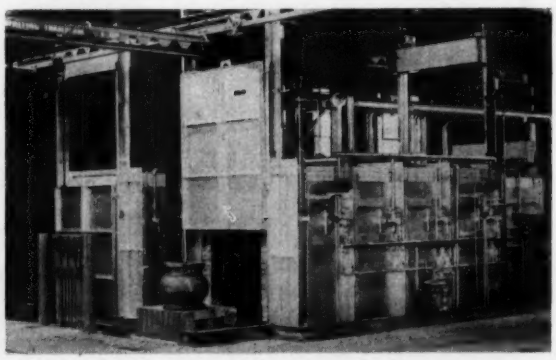
materials and screw them together from the reverse side of the mold. The adhesive was introduced by Eastman Chemical Products Inc., a subsidiary of Eastman Kodak Co., New York.

For More Details Circle No. 498—Page 53

Furnace Features Continuous Operation

GAS-FIRED, CAR BOTTOM furnace installed in a Midwest foundry anneals, preheats before welding, and stress relieves after welding. Normally, the welding preheat furnace holds five cars. Operator controls operation of the furnace with pushbuttons.

When the door is fully opened, as shown, a car comes out of the furnace. Casting is removed from the car, return button pushed, and the car goes back into the furnace. Door closes automatically. After welding, a car comes out of furnace "B," the casting is placed on this car and returned to the furnace. This



procedure is followed until all castings on the first car have been moved to the stress relieving furnace. An empty car is pushed into the second furnace, after removal of the full car, while a loaded car is pushed into the preheat furnace. Furnace is designed and built by Waltz Furnace Co., Cincinnati.

For More Details Circle No. 499—Page 53

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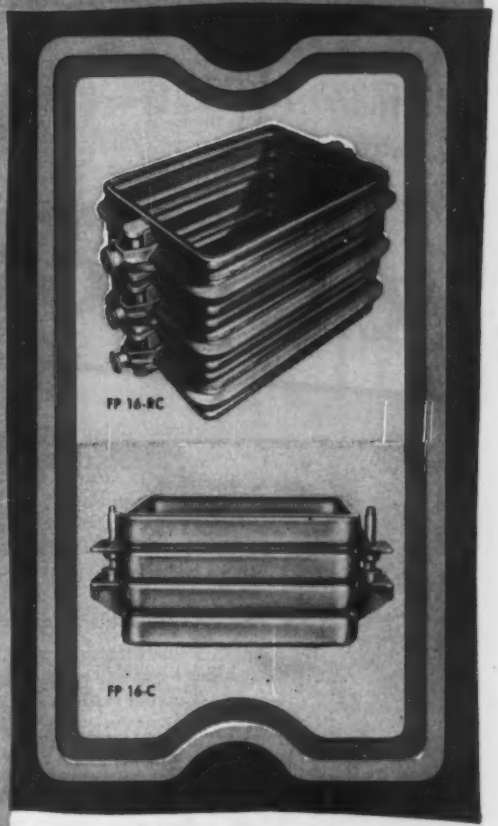
Circle 684 on Page 53

GREATER STRENGTH-INSIDE



by American of course

Added strength and rigidity of these flasks by American lies in the inside corrugation. American INSIDE STRENGTH of the ¼" walls actually assures more rigidity than other type reinforcements, more resistance to squeeze of air pressure. Inside corrugation of the walls assist in holding sand—makes for easier shake out, and means that the flasks will maintain their shape and pincenters — give better, longer service.

★ Sturdy, durable streamlined design
★ Low Maintenance Cost ★ Easier to Handle

The number of inside corrugations is determined by depth of sections. For extreme pressure, sections may also be furnished with American's special channel welded reinforcement.

AFFCO superior flasks are the result of over 25 years research and best possible workmanship. Write for our complete Flask Catalog.

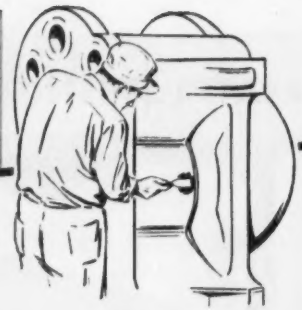
Our facilities assure you of prompt fabrication and quick shipment of your orders.

Visit our booth #410 at the Foundry Show in Phila. in May.

affco
Division of Cromb & Gegel, Inc.

AMERICAN FOUNDRY FLASK COMPANY
2745 SOUTHWEST BLVD.
KANSAS CITY 8, MO.

Circle 685 on Page 53



These features mean

BETTER LOOKING CASTINGS

TIGHT, LASTING REPAIRS

When correcting blow or sand holes, surface blemishes, or rough and porous areas in castings, you can depend on Smooth-On Foundry Cements, standard of the industry for more than 63 years. They are easy to apply, harden quickly, stay firmly in place.

THREE DIFFERENT SHADES

With 3 different shades to pick from, you know you can get a close match for your castings.

4AA—Light gray, fine texture
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Rigid quality control means you can be sure that the strength and color of Smooth-On Foundry Cements will not vary from one order to the next. Every lot of Smooth-On cements is laboratory tested and must satisfy tests for setting time, hardness, and color before it is packed for shipment.

FREE SAMPLES

Why not try one or more of these Foundry Cements at our expense? We will be glad to send you a free sample of any of the cements described above if you will write us on your business letterhead. Write today, and see how Smooth-On can improve the appearance of your castings.

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FOUNDRY CEMENTS

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Graco Fast-Flo Pumps reduce handling costs. They transfer measured amounts of different fluids direct from original containers. Ideal for batching, applying or mixing . . . fluids are transferred quickly and safely. Aids good housekeeping; eliminates contamination.

Send for more information about this amazing *Graco* Fast-Flo that's suited both for large and small operations. It handles materials as thin as alcohol, as thick as cookie frostings! Fast-Flo Pumps are also available in stainless steel. Send for free idea booklet!

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MODEL K

SPECIALLY SUITED TO PRODUCE FERROUS AND NON-FERROUS LONG TUBULAR CASTINGS

Castings up to 32 inches in diameter and 20 feet in length. These machines are ideal for jobbing foundry work as well as production.

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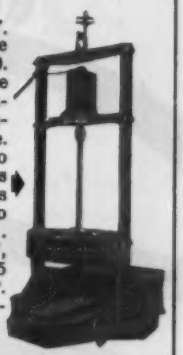
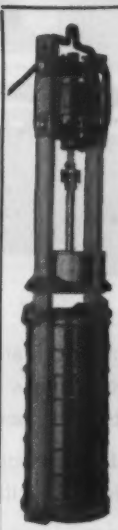
COMBS GYRATORY RIDDLES

"Greatest Name in Motion"

TYPE "CR". Complete price $385.00. 24" dia. round sieve. Sifts, fluffs, mixes, aerates sand. Height 4'6", weight 250 lbs., 1/3 H.P. enclosed motor.

TYPE "CS". Complete price $395.00. 24" square sieve. A continuous operation sieve. Requires no dumping, as refuse is ejected off to one side. Height 4'10", weight 295 lbs, ½ H.P. enclosed motor.





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- Test data complies with Federal Specifications QQ-1-652.
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- Tester is bench type, requires little space. Low in cost and trouble-free.

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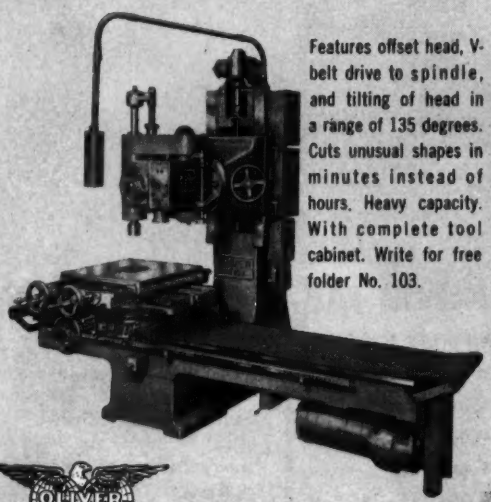

Features offset head, V-belt drive to spindle, and tilting of head in a range of 135 degrees. Cuts unusual shapes in minutes instead of hours. Heavy capacity. With complete tool cabinet. Write for free folder No. 103.

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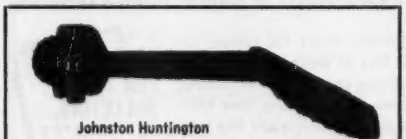

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WOLVERINE turntable DOWN DRAFT dust collecting benches

Type BT

PLUS — Superior dust collection due to higher down draft velocity (standard 300 feet per minute or, if application requires, velocities up to 800 feet per minute). Heavy duty industrial viscous filters in rear compartment remove dust from air stream and axial flow fan in top of compartment exhausts air vertically indoors or out, as required.
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BY STEPHENS-ADAMSON

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Accurately formed Curve Crown on rim outer ends eliminates belt stretch and wear . . . increases belt training effect more than 100%.

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Absolutely round one piece pulley rims formed under hydrostatic pressure. Seam machine-welded inside and out insures 100% weld penetration.

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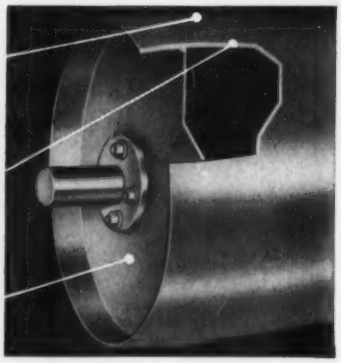
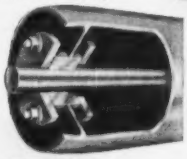
End plates O.D. and I.D. machined to insure concentricity between bore and outer rim. Pressed fit . . . submerged arc welding for maximum efficiency.





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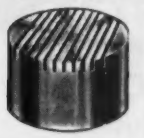
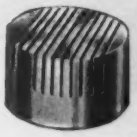


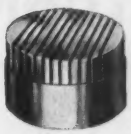
SHALLOW

DEEP



EXTRA DEEP

CONCAVE



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Wherever molten metal contacts refractory linings, slag-resistant DFC refractories assure you longer service and performance economy.

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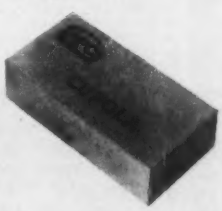

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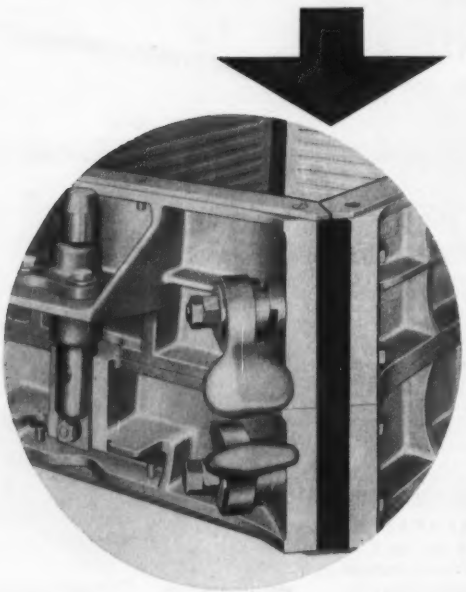

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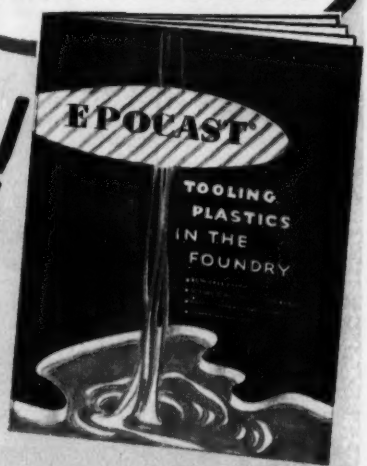

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Desire man 30-40 years of age with necessary drive and skill to organize department. Must have knowledge of the various cleaning room processes including welding, heat treating, arcair and materials handling methods. Reply giving age, resume of experience, personal background and salary requirements. All replies held in confidence:

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RESEARCH METALLURGIST

Opportunity in Research Laboratory of leading steel castings producer. Applicant must have B.S. in Metallurgy or Metallurgical Engineering and some experience with steel. Work involves studies of melting, alloying and heat treatment of steel. To age 35. Salary commensurate with experience and ability. Write John A. Rassenfoss, Manager Manufacturing Research Laboratory, American Steel Foundries, 3761 Canal Street, East Chicago, Indiana.

FOUNDRY SUPERINTENDENT

Foundry superintendent wanted. Must have experience in squeezer and rollover molding. Some cupola knowledge will be helpful. Must be able to estimate weights from blueprints. If you are able to meet these qualifications, state age, references, salary desired, and telephone number. Address: Box 247, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT

For gray iron foundry 35 miles from New York. Sand slinger and rollover experience, 79 men. Knowledge ductile iron, bronze and aluminum desirable. Salary to start $10,000. In reply give complete record and availability. Address: Box 254 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

INVESTMENT FOUNDRY SUPERINTENDENT

Man capable of taking complete charge of investment foundry. Must be good production man, completely familiar with all phases of investment casting. Reply giving complete details including resume of experience, personal background and salary requirements. All replies held in confidence. Mid-West location. Address: Box 245, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

METALLURGIST

B. S. Degree. A man with at least five years experience. We produce gray iron and ductile. Please provide complete background in first letter including references and salary desired. Ohio location. Address: Box 280, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

QUALITY CONTROL MANAGER

Wanted for Michigan area Squeezer Foundry pouring 1,200 tons per month. Must be fully experienced in all phases of casting quality control. Address: Box 270, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

Progressive Central Ohio Foundry has an opening for an experienced supervisor. Must be a journeyman and have had sand mixing, heavy dry sand molding and ferrous foundry experience. Excellent employee benefits and opportunities. Furnish resume stating education, experience, and qualifications. Salary open. Address: Box 297, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• HELP WANTED

METALLURGIST

Required by progressive and expanding internationally known company manufacturing specialized chemical products for the foundry industry. Applicant should preferably be under 35, possess a metallurgical degree and have had several years' experience in foundry work. Thorough knowledge of casting defects, metallography and photography is essential. The position offers prospects of advancement for an able man and a good starting salary will be paid. Applicants should submit a resume of qualifications to:

FOUNDRY SERVICES, INC.
P. O. BOX 8725
CLEVELAND 35, OHIO

MANAGER'S ASSISTANT

For cast iron plumbing fixture plant, needs rounded out knowledge to back up manager. Address: Box 272, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• POSITIONS WANTED

GENERAL FOREMAN CLEANINGROOM

Thoroughly experienced in all phases of cleaningroom operations. Now available. Wishes to relocate. Would like position with future. Have good cost-quality, labor-relations record. Resume upon request. Address: Box 305, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MASTER PLASTER MOLDER

Capable of setting up and operating plaster foundry. Experienced in pressure castings, precision castings, tire and foam rubber molds. Address: Box 309, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

YOUNG FOUNDRYMAN

Seeks progressive position in U.S.A. or Canada. Seven years in foundry industry. Experienced all aspects foundry production, especially High Duty C.I., excellent practical and technical qualifications G.I. Mech E, Grad I Prod E, A.I.B.F. Mechanite Diploma, H.N.C. Mech E, etc. At present in final year National Foundry College Wolverhampton. Holds responsible position in U.K. Address: Box 299, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANAGER-SUPERINTENDENT

Age 43. 27 years experience in all phases of gray iron foundry, practical and technical, proven ability in ductile and high strength gray irons, basic and acid cupolas, jobbing or production. Address: Box 302, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

EXPERIENCED GRADUATE ENGINEER

Qualified General Superintendent is seeking a position with a progressive concern. Broad and varied knowledge of all phases of steel foundry functions. Presently employed. Will relocate. Address: Box 308, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANAGER—SUPERINTENDENT

Aggressive practical foundryman technically trained. Thirty years' background jobbing and production, producing quality work at minimum costs. Small and large castings. Results obtained. Age 55. Address: Box 295, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Competent and progressive with good record. Desires to make change. Will relocate. Address: Box 284, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY TROUBLE-SHOOTER

Former foreman and superintendent. Thoroughly experienced and expert on sands, facings and gating. Qualified for spot trouble-shooting with gray iron and alloys experience. Desire part time employment. Address: Box 258, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ENGINEER-SUPERVISOR

Graduate Engineer, M.S., age 28, seeks supervisory or technical position with progressive ferrous foundry. Have practical and technical experience as superintendent and engineer, of Meehanite and ductile iron foundry. Know latest methods, cost, quality, and production controls. Address: Box 294, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• POSITIONS WANTED

FOUNDRY ASSISTANT MANAGER
Graduate foundryman experienced in all phases of gray iron mechanized foundry operations, up-to-date on latest developments and methods, cost and quality minded, now employed, desires relocation including overseas assignment. Address: Box 298, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

LOAM MOLDING
Twenty years in all phases of loam molding, pitting and pouring. Also, specializing in large cast iron pipe fitting. Must relocate due to closing of Loam Department. Address: Box 269, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOREMAN OR SUPERVISOR
17 years experience in nonferrous—cleaning, core making, molding, melting, gating and pattern layout. Progressive. Will relocate. Address: Box 257, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT-MANAGER
Practical, progressive and technical foundryman. 28 years in ferrous and nonferrous jobbing and production foundries. Sales and metallurgical background. Well versed in all phases of the foundry. Good trouble shooter. Age 47. Address: Box 285, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN
Experienced in gray iron and nonferrous metals, mechanization, design, patternmaking, gating, risering, costs. Presently employed as pattern supervisor. Address: Box 260 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

EXPERIENCED FOUNDRYMAN
Including economic basic and acid cupola and metal control, casting defects, sands. Age 48, will relocate. Address: Box 282, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

GENERAL FOREMAN OR SUPERINTENDENT
Practical gray iron and steel foundryman, technically trained, broad experience, light and heavy castings. Well versed on casts, metal sand, and scrap control. Desire to relocate in Southwest, Midwest or overseas assignment. Now employed. Address: Box 268, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

INDUSTRIAL EXECUTIVE
Experienced in all phases of selling and manufacturing at top management level. Graduate engineer; "C" process specialist; able administrator capable of establishing new division or profitably operating and expanding existing facility. Married, age 45. Presently located midwest but willing relocate home or abroad. Address: Box 256, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CORE ROOM SUPERVISOR
Progressive. Experienced all types cores, steel and gray iron. Know sand mixes. Qualified to take complete charge. Any location. Address: Box 296, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SALES POSITION
Graduate of Naval Shipyard Apprentice School (foundry practice) also college graduate Business Administration. Several years' sales experience, desires position in sales. New England area preferred. Address: Box 281, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT
Thirty-four years' experience, ferrous and nonferrous, practical and technical, twenty years' supervisor. Prefer small shop. Now employed. Age 55. Address: Box 293, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN
With 25 years' experience wishes to represent foundries, foundry suppliers or allied products in Indiana and Ohio. Address: Box 243, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• REPRESENTATIVES WANTED

SALESMAN
With following among ferrous foundries to sell established national foundry product for Michigan, Minnesota, Illinois, Wisconsin territory. Write complete background, experience. Address: Box 303, FOUNDRY, Cleveland 13, Ohio.

REPRESENTATIVE WANTED
We would like a man who is currently calling on pattern shops and foundries to sell a complete line of pattern lacquers. Address: Box 259, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• REPRESENTATIVES WANTED

SALES REPRESENTATIVE
Desired in New Jersey for Eastern Pennsylvania gray iron foundry which offers rough iron castings or castings plus complete machining, finishing and assembly facilities. Address: Box 291, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

BRITISH FOUNDRY EQUIPMENT REPRESENTATIVE
New York importer representing top British manufacturers of foundry and engineering machinery requires experienced sales engineer with good technical and practical knowledge of foundry procedures and equipment to introduce, promote and sell British equipment in U. S. market. Must have successful sales experience, initiative and organizing ability. Location, New York. Send full details: age, education, experience, marital status, salary required. All details held in strictest confidence. Address: Box 274, FOUNDRY, Penton Bldg., Cleveland 10, Ohio.

SALES REPRESENTATIVES WANTED
We are a Cleveland area nonferrous foundry, looking for sales representatives to market our products in Ohio and surrounding areas. We can supply production commercial castings, plus several specialized products, prompt competitive quotations and technical service. If you can provide opportunities for successful sales and close customer follow-up, please contact us. Address: Box 306, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SALESMAN
Large gray iron foundry in New England needs foundry salesman for New Jersey and Pennsylvania area. Must have sales and gray iron foundry experience. Salary open. Address: Box 287, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SALESMAN
To sell foundry equipment and supplies for foundry supply house. Territory Illinois and Indiana. Car furnished. Send full resume to: Box 288, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• REPRESENTATION WANTED

REPRESENTATION WANTED
For internationally known foundry equipment. Exclusive key areas open for experienced men with sound foundry following. Please list present lines: all replies strictly confidential. Interviews at Convention.

BOX 276, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

SALES REPRESENTATION
Magnesium and aluminum foundry wants top flight sales representation. Unlimited production capacity as to size and type of castings. Address: Box 307, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPPLIERS LIMITED, 25a COCKSPUR STREET, LONDON, S.W.1., ARE SEEKING ADDITIONAL AGENCY IN GREAT BRITAIN FOR LATEST FOUNDRY EQUIPMENT.

FOUNDRY SUPPLY HOUSE
Covering Michigan, Minnesota, Illinois, Wisconsin, Missouri to represent old line manufacturer of ferrous foundry riser compound. Write with complete particulars to: Box 304, FOUNDRY, Cleveland 13, Ohio.

• ACCOUNTS WANTED

REPRESENTATION AVAILABLE
Former Foundry Vice President with good casting sales background and contacts, launching a new venture as representative and wishes to establish a complete casting service. Eastern Pennsylvania, New Jersey, Delaware and Maryland. Address: Box 275, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ESTABLISHED REPRESENTATIVE
Desires to represent Steel Foundry capable of producing castings 1 to 10,000 lbs., prefer electric furnace operation, carbon, low alloys. Have active following steel castings field, Northern Ohio. Three man office, headquarters Cleveland. Address: Box 277, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOUNDRIES FOR SALE

TURNER FOUNDRY FOR LEASE
All metal and masonry building approx. 12,500 sq. ft.
Concrete floors, sprinkling system and R. R. siding
Modern Trumelt cupola #1 42 x 32
American Wheelabrator Tumblast
American Rotary Wheelabrator
Twin grinders connected with dustube dust collector system to all cleaning equipment
Overhead traveling electric crane
Core baking equipment
And all equipment needed for immediate operation
Adequate labor, both skilled and unskilled, is available
For further information contact:
L. GORDON
DRAWER 1192
STATESVILLE, NORTH CAROLINA

FOUNDRY FOR SALE
Fully equipped now operating gray iron foundry in western New York State for sale. Located near the New York Power Development. Reason for selling, present owners want to retire.

BOX 250, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY FOR SALE
Aluminum and brass sand casting foundry in one of the most active areas west of the Mississippi. Employs 25 to 35 and has all the accounts that can be handled with present plant. Ground for expansion included and space in present building available for manufacture or assembly. Large permanent mold account available. Complete labor harmony, a real opportunity for a good foundryman or company. Address: Box 278, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOR SALE
Small gray iron Foundry and Machine Shop operated past 40 years by present management. Good backlog—only Foundry in 15 mile radius. Thousands of Customers' patterns in addition to own end product, designs, patterns and advertising literature. Owners retiring—Total sale price $95,000. Will take mortgage for $30,000. Address: Box 290, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ALUMINUM AND BRASS FOUNDRY
For sale. Fireproof building 7200 sq. ft. In profitable operation, bluechip customers of long standing. Vicinity of Milwaukee, Wisconsin. Address: Box 262, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• OPPORTUNITY

We are offering the manufacturing rights for a heavy-duty

SANDMIXER
U. S. A. PATENT NO. 2,808,239

The most up-to-date and efficient machine developed in Europe during the last years. The high-speed novel mixing system of this machine permits the shortest mixing performance and is suitable for any kind of sand, including coated sand.

Foundry Machine Manufacturers interested in the new sand mixer are invited to apply:

BOX 279, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

PERMANENT MOLD METHOD AVAILABLE

THE WAGNER PERMANENT MOLD CO., 2910 Empire Ave., Burbank, California, has developed a Permanent Mold Method for ferrous and nonferrous metals and invites inquiries from any country regarding this method and process.

REPUTABLE MANUFACTURER WANTED
Wishing to buy into foundry capable of pouring 8000 pounds cast iron castings, 1500 pounds aluminum or brass a day. Foundry located in Eastern Pennsylvania, excellent freight service to New York, Philadelphia and Baltimore areas. Going concern with experienced personnel. Located in good potential area. Address: Box 252, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• EMPLOYMENT SERVICE

FOUNDRY PERSONNEL SPECIALISTS

National Placement and Procurement of

GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS

Confidential Inquiries Invited
From Employers and Qualified Applicants

For Fast Competent Assistance Contact

DRAKE PERSONNEL, INC. **FINANCIAL 6-8700**
JOHN COPE, DIRECTOR, 29 E. MADISON ST., CHICAGO 2, ILL.

PLANT ENGINEER
$11,000 TO $13,000

Progressive midwestern foundry, that places high value on engineering ingenuity, seeking promotable type man, to assume complete charge of new installations and maintenance. Company assumes all expenses. Contact Bill Newell.

MONARCH PERSONNEL
28 EAST JACKSON BOULEVARD
CHICAGO 4, ILLINOIS

• FOUNDRY CONSULTANTS

FOUNDRY CONSULTANT

Formerly foundry engineer, Whitehead Metals Inc. (subsidiary International Nickel Co.). Ferrous and nonferrous foundry practice, covering nickel, monel, brass and bronze, alloy irons and steels. Cupola, electric and crucible furnace operation. Phone DElaware 7464. Address: Joseph Nixon, 1175 Colvin Avenue, Kenmore 23, New York.

FOUNDRY CONSULTANT-NONFERROUS

Sand casting—permanent mold casting—centrifugal castings — in aluminum — brasses — bronzes —30% leaded bronze—aircraft quality bearings and castings. Address: ED JENKINS, 286 PENOBSCOTT BLDG., DETROIT 26, MICHIGAN, PHONE: WOODWARD 5-7947.

• CAPACITY WANTED

GRAY IRON FOUNDRY WITH MACHINE FACILITIES

To quote competitive price per lb. on barbell plates, as well as manufacture complete barbell—dumbell sets for direct shipment on order, to customers. N. J.—eastern Pa. area. Address: Box 251, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• WANTED-TO-BUY

IF YOU OPERATE
A FURNACE

We will purchase your scrap linings, retorts, conveyors, muffles, racks, etc. Any item made of nickel alloy, Write, Wire or Call:

WEINSTEIN COMPANY
610 W. 8th STREET
JAMESTOWN, NEW YORK
PHONE: 61-154

SAND CONTROL SYSTEM

Wanted—8 station overhead sand control system, fully equipped.

Supply full data.

BOX 265, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

MIXER WANTED

Used Simpson Intensive Sand Mixers, State size, condition and lowest cash price for immediate acceptance. Address: Box 263, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• WANTED-TO-BUY

WANTED

IRON PIGGING MACHINE, Bailey Type 2 Ton/Hr.—40 lb. Pigs
Address: Box 248, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

STRIPPING MACHINE WANTED

For use with Sand Slinger.
Large enough for Molds to 60" wide.
Quote price and condition.

BOX 266, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

WANTED

One good used late model #3, 3H or 3F Simpson Mixer — complete. Address: Box 264, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED

Used or Broken Silicon Carbide Grinding Wheels of any kind or size, regardless of bond. Will pay $35.00 per ton. Union Mining Co., 1st Nat'l. Bank Bldg., Pittsburgh 22, Pa.

WANTED

Used Joy or Sullivan compressor, V type, 100 HP, 440 V., 60 cycle, 3 phase with intercooler. Address: Box 289, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOR SALE

FOR SALE

PREPARATOR #60 B & P, excellent condition, may be seen in operation—priced low
CONVEYOR, Link-Belt, OSCILLATING PAN-TYPE 24" x 60', rebuilt and guaranteed
SIMPLICITY SHAKE-OUT 6' x 8' heavy-duty, w/Motor—good buy
MOULDERS FRIEND Sand Conditioner, 50" w/Extra Brush, One-Way, Excellent buy
P & H OVERHEAD CRANE for fast and heavy work, 115 Volt D C, 37'-2" Span—good buy—5 ton capacity
For this and other good equipment contact
W. O. McMAHON
BOX 5799 HOMEWOOD STATION
BIRMINGHAM 9, ALABAMA
Phones: TREMONT 1-2088 and 9-6170

FOR SALE

SIMPSON 1½ Sand Mill
6 cubic foot capacity; fully equipped with Bucket Loader—Aerator—Dust Hood

Excellent Condition

BOX 261, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

REPAIR AND REBUILDING SERVICE ON ALL PNEUMATIC TOOLS

We try to carry a complete line of "Hard Chrome Rebuilt Tools" at about half the cost of new tools. Before you discard your old tools, why not send them to us for our estimate on the cost of renewing them with our Hard Chrome Process?

CENTRAL PNEUMATIC SERVICE, INC.
512 LINDEN AVENUE
DAYTON 3, OHIO
PHONE: CL 2-2701

• FOR SALE

QUITTING BUSINESS
GIGANTIC LIQUIDATION
MUST VACATE PREMISES
WITHIN 30 DAYS
USED FOUNDRY EQUIPMENT

Molding Machines
Core Blowers
Fans and Blowers
Melting Furnaces
Grinding Equipment
Hoists
Ladles
Pouring Devices
Sand Preparation Equipment
Vibrating Equipment
Welders
Cleaning Equipment
Dust Collectors
Miscellaneous Equipment and Supplies

HOMAN MACHINERY COMPANY
MAIN 1-0339
1144 HARRISON CINCINNATI 14, OHIO

SAND BLAST EQUIPMENT
SELL—BUY—TRADE
GUARANTEED MACHINES
TERMS: 3 YEARS TO PAY

48 x 48 Wheelabrator Tum. w/loader	$5000.00
42 x 48 Wheelabrator Tum. w/loader	3750.00
27 x 36 Wheelabrator like new	4500.00
20 x 27 Wheelabrator like new	3500.00
6' Wheelabrator Table	3500.00
8' Wheelabrator Table	3000.00
9' LG Pangborn Table	5000.00
7 GK 2 Pangborn Bbl.	1500.00
4' LG Pangborn Table like new	4250.00
14' LG 5 Pangborn Table	9000.00
Pangborn Shop Peen Cabinet	1100.00
Pangborn 53 EN2 Hand Cabinet	325.00
Pangborn IGF Air Barrel	450.00
Rumelin 8 x 8 Room	1200.00

All types and sizes of Hand Cabinets, Dust Collectors, Pressure Tanks, Rooms, Vapor Blast Cabinets and additional sand blast equipment too numerous to mention.

DIAMOND SALES, INC.
5654 W. JEFFERSON
DETROIT 9, MICHIGAN
VI 3-6750

FOR SALE

Pangborn ROTOBLAST table 9 LG with 8-28" multi tables	$4250
TABOR 10" Jolt Pin Stripper	$225
TABOR 10" Molding Machine	$80
Pangborn EN2 Cabinet	$250
Flasks 50" x 40" 12 over 24"	$55
Round Flasks 48" x 48" x 6"	$18
Flasks 15" x 23"	$12

M. ELSTEIN
426 GRAND STREET
JERSEY CITY 2, NEW JERSEY

FOR SALE

Used Gray Iron Foundry Equipment
Molding Machines, Flasks

Write For Complete Listing

A. Y. McDONALD MFG. COMPANY
P. O. BOX 508
DUBUQUE, IOWA

FOR SALE

Hough Payloader Model HA
(New Dec. 1955)
Roots-Connersville 18 x 54 RCS
Positive Blower—7100 CFM @ 24 oz.
60 H.P. Motor w/Starter
(New—1954)
2—Like New Reliable Tumblers 30 x 48 and 42 x 54
10 Tons—STEEL FLASKS 12 x 18 to 42 x 42

FRANK ADAMS & CO., INC.
2110 MONROE AVENUE MELROSE 1-3900
CINCINNATI 12, OHIO

FOR SALE

BEST OFFER for 36" x 42" Wheelabrator Tumble Blast. Running condition. WRITE ONLY —Box 303, Agawam, Mass.

• FOR SALE

FOR SALE

Air Roto Blast Barrel—14" W x 24" dia.
Air Compressor—100 HP 452 CFM @ 100#
Blower—5500 CFM 43 oz-100 HP motor
Blower—1000 CFM 34" WP 10 HP motor
Blower—450 CFM 24 oz. 5 HP motor
Blower—Maxon Premix ¼ HP motor
Exhauster—28" inlet; paddlewheel
H.T. Furnaces—Box-pit-Pusher-Rotary
Harden-Quench-Wash-Draw H.T. Setup
Heat Exchanger—B & Gossett 75 GPM
Magnetic Pulley—18" dia. 28" face
Quench Tank—42" x 42" x 8' w/baskets 2
Quench Tank—8' x 8' x 8' w/agitators

WOLCO EQUIPMENT COMPANY
326 EAST 2nd STREET GA 1-6772
CINCINNATI, OHIO

FOR SALE

One Model SP-1100 Sutter Shell Mold Machine Complete, in good condition

Contact:
COOPER ALLOY CORP.
BLOY ST. AND RAMSEY AVE.
HILLSIDE, NEW JERSEY

• FOR SALE

FOR SALE

1—Simpson #0 Muller—Style M (never used)
1—Simpson 18" Muller
1—Lancaster Mixer, Model EGB-4
1—Lancaster Mixer, Model EAG-3
3—Link Belt Roto Louver Rotary Dryers, Models 207-10, 310-16 and 604-20.

R. GELB & SONS, INC.
U. S. HIGHWAY 22, RAHWAY VALLEY R. R.
UNION, NEW JERSEY

FOR SALE
MOTOR—GENERATORS
TRANSFORMERS
Unused—Rebuilt
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT COMPANY
Phone station Collect GLenwood 3-6783
P. O. Box 51—Rochester 1, New York

FOR SALE

Patterns—aluminum match plates—for ornamental novelty castings, door stops, animals, book ends, banks. Also fireplace dampers, clean-out doors, ash dumps. All in good condition. Reasonable. Address: Box 283, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOR SALE

CONVEYOR BELT

Heavy duty, unused. 2500-3000# cover tensile, 16-19# friction pull.

4 ply 28 oz. duck:		LIST	SELL
14"—1/8" x 1/32"		$4.48	$2.60
16"—1/8" x 1/32"		5.06	2.93
18"—1/8" x 1/32"		5.61	3.26
18"—1/8" x 1/16"		5.92	3.44
20"—1/8" x 1/32"		6.14	3.56
24"—1/8" x 1/32"		7.22	4.18
24"—1/8" x 1/16"	(5 ply)	8.78	5.09
4 ply 32 oz. duck:			
30"—1/8" x 1/16"		9.92	5.75

Many other sizes. Samples on requests. Distributor inquiries invited. Phone collect.

PALTECH COMPANY
NEW CANAAN, CONNECTICUT
WO 6-4126

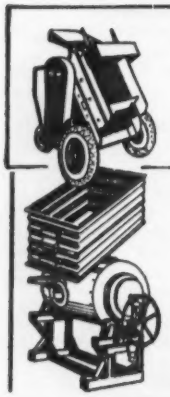
FOR SALE

Electric Ram lift Truck for handling coils. 20,000 lb. capacity.
Can be converted to forks. Good condition. Also Electric Platform Truck—20,000 lb. capacity.
Call Mr. Telenzak at BAldwin 6-1200, or write:

MOBILE INDUSTRIAL
9th AND TIOGA PHILADELPHIA 40, PA.

SHELL CORE MACHINE FOR SALE

One SPO Model SC-10-DM Shell Core Machine. Condition like new. Make offer. Box 249, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.



EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD CLEVELAND 10, OHIO

WHEELABRATORS
3—6 cu. ft. Continuous Tumblast
1—20" x 27", 2 cu. ft. Tumblast
1—42" x 48", 17½ cu. ft. Tumblast with loader
1—6' Table Airblast w/six aux. tables
2—6' Table Pangborn LF and LE

WANTED!
COMPLETE FOUNDRIES,
SMALL/LARGE.
PROMPT SERVICE.

MOLDING MACHINES (Automatic)
2—TDA4 Taccones

CORE OVEN
1—Di-Electric, Model CD-25
Coleman, 30 KW.

SWING GRINDERS
10—10 H.P. Mummert-Dixon Model 1814

ELECTRIC FURNACE
1—Heat-Treat, Lindberg, 72 x 84 x 96, car type, 105 KW, 220v, 3 ph., 1250°F.
1—350 lbs. Detroit Rocking

— **GLENVILLE 1-1222**

Circle 870 on Page 53

CLASSIFIED ADVERTISING RATES

(Effective Jan. 1, 1960)

POSITION WANTED—Minimum advertisement set solid.
30 words or less $4.00
Additional words .....15c each.

ALL OTHERS—Help Wanted, Employment Service, Wanted-To-Buy, Representatives Wanted, For Sale etc. minimum advertisement set solid,
30 words or less $10.00
Additional words .....35c each.

NOTE: If replies are to be sent to a box number in care of FOUNDRY, add 8 words to your advertisement for box number and address.

Any advertisement set in all capital letters, add 50% to the above rates.

Classified forms close the 13th of month preceding issue.

FOUNDRY
PENTON BUILDING CLEVELAND 13, OHIO

INCH RATES PER INSERTION

Single Column 2¼" Wide	One Time	Three Times	Six Times	Nine Times	Twelve Times
1 inch	$ 27.75	$ 26.25	$ 24.75	$ 24.00	$ 23.25
2 inches	54.00	51.00	48.00	46.50	45.00
3 inches	78.75	74.25	69.75	67.50	65.25
4 inches	102.00	96.00	90.00	87.00	84.00
5 inches	123.75	116.25	108.75	105.00	101.25
6 inches	144.00	135.00	126.00	121.50	117.00
7 inches	162.75	152.25	141.75	136.50	131.25
8 inches	180.00	168.00	156.00	150.00	144.00
9 inches	195.75	182.25	168.75	162.00	155.25
10 inches (1 col.)..	210.00	195.00	180.00	172.50	165.00
15 inches (1/2 page)	303.75	281.25	258.75	247.50	236.25
20 inches (2/3 page)	390.00	360.00	330.00	315.00	300.00
30 inches (1 page)	562.50	517.50	472.50	450.00	427.50

Remittance should accompany advertisement when submitted —Cash Discount 2%, 10 days.

AAA MACHINERY & EQUIPMENT CO.

over 1000 satisfied customers

WORLD'S LARGEST INVENTORY OF GUARANTEED FOUNDRY EQUIPMENT

AIR & ELECTRIC HOISTS

85—I & R Air Motor type, sizes A, B, C, D, D-6 & E, ¼, 1, 2, 3 & 5 ton.
15—DETROIT Air Hoists, 1, 1½, 5 ton cap.
1—DETROIT Model LHR, 5 ton, elec.
20—THOR air hoists, ½, 1 & 2 ton cap.

BUCKET ELEVATORS

12—LINK-BELT & JEFFREY, 30, 40, 50, 60 ft. cc, 10 x 7, 12 x 7, 14 x 7, 16 x 8 buckets.

CUT-OFF MACHINES

1—TABOR C10AF, 16" wheel, 10 HP.
3—TESSEMER H & I Sprue Cutters.

CORE BLOWERS

3—CHAMPION Model CB-10, CB-18, & CB-400. From 10 to 300 lb. Cores.
22—DEMMLER #50 Model 1, 1E, 2, 2E, 2K, 3, 3E, 3K, 4 & 4E. 10 to 100 lb.
1—FEDERAL 40P-1 San-Blo.
7—INTERNATIONAL Model SB-11 & SB-13, SB-15H, 15 to 30 lb. Cores.
6—OSBORN Nos. 91, 92, 192 and 193. From 10 lb. to 75 lb. Cores.
2—REDFORD #2—Magazine type.
1—SAN-BLO Model CB-40-B. 40# Cores.
1—SPO Model SC-10-DM, hollow core.

CORE OVENS

1—INDUSTRIAL "Revolving Carriers" continuous, 18" x 80" trays.
2—PORBECK Batch type 10' L x 8' W.
1—DESPATCH Type "S" 6' w x 16½' l x 7¼' h Oil Fired.
1—FOUNDRY EQUIP. 3 comp. 6' x 7' x 12' ea. Gas or oil.
1—THERMONIC Model M800A Dielectric. Cap. 900#s per hour.

CUPOLAS, BLOWERS & EQUIP.

1—SPENCER 150 HP 7500 CFM 48 oz.
6—I & R Centrifugal 30, 50, 85 and 100 HP, 3500 to 10,500 CFM w/blast gates.
1—CUPOLA Bondactor, style 1205-L.

ROTO-CLONES WET TYPE

9—AMERICAN AIR FILTER Type N&W. Sizes No. 20, 24, 27, & No. 30, w/sludge ejectors, cap. to 30,000 CFM.

ELECTRIC MELTING FURNACES

4—DETROIT LFA, 350# Cold Charge 700# Molten w/200 KVA transformers.
1—TOCCO 20 KW Induction, 9600 cycles.
3—AJAX No. 100 & 300 Furnaces Only.
6—AJAX 35 KW Induction 460 V 1 phase.
1—DETROIT Size CM—4000# Charge, 8000# Molten, w/1000 KVA trans.
2—AJAX 20 KW Hi Frequency Converters.

GAS & OIL FIRED FURNACES

23—LINDBERG FISHER Model MNP electric Tilt. Sizes 150, 400, 600, 1000, 1700, 2000 & 2400#, alum. cap. Gas or Oil.
29—LINDBERG & HAUSFELD Stationary. Sizes 100, 150, 200 & 550 cap.
1—LINDBERG #400 BEI hand tilt.
1—SKLEENAR 1200# Rev., hand tilt.
1—MONARCH 600# Rev., hand tilt.
1—STROMAN, "U" 600# Reverb.
1—STROMAN DC "Dipout" 800# cap.
1—ECLIPSE E1000—Double Chamber Dry Hearth 1000# cap.

GRINDERS

Swing Frame

1—FOX #4 Wheel 24" x 3"—20 HP.
1—MARSCHKE 20" x 10" wheel, 10 HP.
3—MARSCHKE 24" x 3" wheel, 15 HP.
2—U. S. ELEC. Model 24, wheel 24" x 3".
1—MUMMERT-DIXON #2420, wheel 24" x 3".

Snagging

4—FOX #7—30" x 3" Wheel, 15 HP.
2—U. S. #64, 20" x 3", 7½ HP, 4 speed.
2—SAFETY #174, 24" x 3" wheel, 10 HP.
2—MARSCHKE 24" x 4" wheel, 20 HP.
1—U. S. #65, 30" x 3", 15 HP, 4 Speed.
U. S. No. 62VS, 24" wheel, 2-7½ HP motor, variable speed.

Core

2—MILWAUKEE 70-12, 70" dia. table.
1—STONEY Core Grinder, 16" dia. Wheel.

Horizontal Disc

GARDNER No. 124—53" wheel, 20 HP.
GARDNER No. 179, 70" dia. wheel, 40 HP.

LADLES

17—MODERN & WHITING Cylindrical Ladles, 275, 2450, & 3000 lbs. capacity. All Enclosed Gears.
37—MODERN & WHITING Lip Pour, Enclosed Gear, 1200, 1600, 2000, 4000, 6000, 7000, 8000 lbs. capacity.
7—MODERN & WHITING Mixing Ladles, 2 & 3 ton. Electric & Manual Tilting.

MOLDING MACHINES

Jolt Squeezers

12—OSBORN No. 275-J—17x20 Table, 10".
15—OSBORN No. 276-J—17x26 Table, 13".
2—OSBORN No. 216-PJ—21-32 Table, 16".
6—MILWAUKEE 123—17x26 Table, 12".
2—MILWAUKEE 181—24x36 Table, 18".
10—INT. PVJS—20x26 Table, 12" cyl.
9—SPO No. 110-J—17" x 20" Table, 10".
8—SPO No. 113-J—17" x 26" Table, 13".

Plain Jolt

1—J&J 50" x 72" table—5000# cap.
2—OSBORN 60" x 72" table, 6000# cap.
1—TABOR 36" x 36" table, 1000# cap.

Jolt Rollover Pattern Draw

1—DAVENPORT 28A, 28" x 44" table.
1—DAVENPORT 28-SA, 29" x 40" table.
2—HERMAN 20" x 30"—750# series.
2—HERMAN 26" x 48"—1500# series.
2—HERMAN 50" x 60"—300# series.
2—HERMAN 40" x 48"—400# series.
1—HERMAN 60" x 84"— 6000# series.
1—HERMAN 60" x 84"—10,000# series.
14—INTERNATIONAL TYPE G., Size 20" x 8", 24" x 10", and 30" x 8".
1—J & J #920 RC—44" x 54"—Hyd. head.
1—J & J #1020 RC—50" x 60"—Hyd. head.
2—J & J #612, 24" x 30" Table.
4—J & J #918, 44" x 54" Table.
1—J & J #815-B, 30" x 40" Table.
1—MILWAUKEE #167, 32" x 33" Table.
10—OSBORN #40 and 42 Core Rollovers.
1—OSBORN #442, 21" x 31" Table.
2—OSBORN #242W, 29" x 42" Table.
12—OSBORN #601 & 602, 30" & 36" Wide Flask, 10" draw, 750 lbs Cap.
2—OSBORN 643 Table 35" x 50"—2000#.
1—SPO No. 9546—26" x 32" Table.
1—SPO No. 917-A—40" x 29" Table.
1—SPO #413D, 24" x 25" Table.
1—SPO Model 508, table size 28" x 30".
1—SPO 5050, Table 25" x 30", 10" draw.
3—TABOR 30" x 40" Table, 12" Draw.
4—TABOR 22" x 42" table, 10" Draw.

Jolt Pin Lift

2—DAVENPORT #34 AJS.
3—INTERNATIONAL JDP 1600 x 10" draw, 36" x 36" Table.
2—INTERNATIONAL JDP 3000# x 10" Draw 48" x 48" table.
1—J & J #8125—30" x 38" Table—10" draw.
1—MILWAUKEE #2542.
2—J & J No. 688 25" x 30" table, 6" draw.
2—MILWAUKEE No. 1030—30x38 Table.
1—MILWAUKEE No. 1536 32x38 Table.
3—MILWAUKEE No. 3548—44x48 Table.
2—OSBORN #559, 25" x 30" table.
1—SPO #3058, 22" x 28" table, 8" draw.
2—SPO #3070, Table 26" x 35", 10" draw.

Pin Lift

2—B & P Model AL 2428 Speed Draw.
1—MILWAUKEE #620 ND Push.
2—MILWAUKEE No. 195.
2—INTERNATIONAL #PK-16.

Jolt Squeeze Pin Lift

1—MILWAUKEE #125, 21" x 27" Table.
3—MILWAUKEE #165, 24" x 30" Table.
3—MILWAUKEE #196, 17" x 38" Table.
1—OSBORN #712-V, 18" x 26" Table.
2—OSBORN #710-J, 17" x 21" Table.
9—OSBORN 714PJ, 20" x 31" Tables.
1—OSBORN #818—24x36 Table, 18" cyl.
1—MILWAUKEE #246—23¼x42 Table.
4—INTERNATIONAL PKL, 17" x 26".
1—SPO #2136-6.
2—SPO 2114P, Table 21" x 27", 11" cyl.
2—SPO 2160-R, Table 24" x 30", 16" cyl.

Shell Molding

1—SHALCO, Model HO4, 2 station.

CONVEYORS

Steel Apron

9—JEFFREY & LINK-BELT 24", 30", 36" widths. Lengths built to your specifications, with reducers & motors.

Oscillating & Vibrating

1—LINK-BELT 48" x 154', 20 HP Motor.
7—JEFFREY TAYLOR No. 5 Vibrating Feeders 24" wide x 7'.
LINK-BELT "FLEXMOUNT"
1—5" W x 50' L x 4" deep pan.
2—18" W x 18' L x 4" deep pan.
2—SIMPLICITY 24" W x 13' L x 6" Deep.
1—SIMPLICITY 18" W x 11' L x 6" Deep.
1—SIMPLICITY 24' W x 19' x 6".

Roller

2500' MATHEWS 6", 14" wide, 2⅞" dia. roller, 1⅛" hex shaft, 4" channel.
1500—MATHEWS 8" wide, 3¼" dia. 1" hex shaft on 6" centers, 6" channel.

Mold

1—DUO-ROLL 88 Cars 20" x 48", 350' track, with automatic dumping.
1—PALMER "B" 106 Cars—42" x 62" w/550' Track.

Belt

LINK-BELT & JEFFREY 18", 24" & 30" wide. Flat or trough idlers, all Timken bearings. Built to your specifications. Can be equipped with molders hoppers & Ploughs.

HOPPERS & STORAGE BINS

1—NATIONAL ENGINEERING "Moulders Helper" 2 Hopper Unit.
7—NATIONAL & LINK-BELT Storage Bins, 60 to 150 tons cap.
1—NEWAYGO HS-7-GT, Handy Sandy.
42—MOLDERS Hoppers 1½ ton cap.

SAND MULLERS

3—B & P No. 80A Speed Muller—24 cu. ft. air cooled.
1—B&P #3½ Mulbaro, 3½ cu. ft.
1—B&P #30 Speedmullor, 4 cu. ft., w/skip Hoist Loader—Air Cooled.
1—B&P #50 Speedmullor, 9 cu. ft., w/skip Hoist Loader—Air Cooled.
1—B&P #60 Speedmullor, 12 cu. ft., w/skip Hoist Loader—Air Cooled.
1—B&P #70 Speedmullor, 18 cu. ft.
1—BESSER Paddle Type, 30 cu. ft.
1—CINCINNATI 24" mullor.
2—CLEARFIELD No. 610 w/skip hoist loaders, 10 to 14 cu. ft. batch.
1—CLEARFIELD #404, 4 cu. ft. batch.
1—DRAVO-DOYLE 6 cu. ft. cap. Port.
1—LINK-BELT 48" x 8' Paddle Type.
2—MASTER 400# Shell Type 5' pan dia.
1—PEKAY No. 160-1-24 Mixer Muller, single stage for 24" belt, 230 TPH.
1—SIMPSON #1-H Style UD, 400# batch.
2—SIMPSON #1½ Style UD, 700# batch w/loader.
2—SIMPSON #2, Style C, 1500# w/loader.
3—SIMPSON #3, Style C, 3000 lb.
3—SIMPSON #3, Style UD, 3000 lb.
2—Mixer Muller, 6 cu ft paddle type.
1—LANCASTER No. EDG-4, 5 cu. ft.
1—LANCASTER #EA-4, 6 cu. ft. w/loader.

SAND PREPARATORS

6—B & P Screenerators, Models S, M & L.
8—ROYER Models, NC-4, NDS, NDP.
6—AMERICAN Sand Cutters, Model M, Sizes 79/60, 89/70, 99/80. All late.
4—AMERICAN Model AA and AM, 45" & 60" Cutting Blade.
1—AMERICAN "Sand Master," 102"/70" Cutting Blade—1952.
2—MOULDERS' FRIEND 50" x 60" Brush.
2—NEWAYGO RS-V Reddy Sandys.
1—SIMPLICITY LP 2' x 3' screen.

SANDSLINGERS

1—B & P 5-ton capacity Plate Feeder.
2—B & P Tractor Type 19" head & 16" head, 13' arms. Magnetic towers.
6—B & P Models DB Stationary Sand Slingers, 16", 19" and 22" heads, with 20, 25, 40 and 50 HP motors. All late.
2—B & P Swing Type Slingers 19" head.
4—B & P 8 ton plate feeders.
2—B & P 35 ton capacity plate feeders.
6—B & P Tanks for speed slingers.
1—B & P Motive 15' Jib—6' Ram—19".
1—B & P Motive Jr. 8' Jib—4' Ram—19".

SHAKEOUTS & SCREENS

2—LINK-BELT 5' x 10', 6 ton cap.
3—SIMPLICITY 4' x 6' Model B.
1—SIMPLICITY 4' x 8' Model D.
1—SIMPLICITY 4' x 10' Model D.
1—SIMPLICITY 5' x 8' Model D.
1—NATIONAL ENG. 5' x 8' Hex Screen.
1—HEWITT-ROBINS 36" x 78" Vibrex.
1—SIMPLICITY 4' x 10' Model B, Single deck sifter screen, 10 HP motors.
2—ROBBINS 3' x 4' JF6—2000#.
1—ROBBINS 6' x 10' JF11—20,000#.

SAND BLAST EQUIPMENT

2—AMERICAN 36" continuous Tumblasts.
1—AMERICAN 36" x 42", w/skip hoist.
2—AMERICAN 48" x 42", w/skip hoist.
1—AMERICAN 27" x 36", w/skip hoist.
1—AMERICAN 48" x 48", w/skip hoist.
1—AMERICAN 48" x 72" w/loader.
1—AMERICAN No. 2 Tablast — 6' dia. Plain Table.
1—AMERICAN #3 Tablast, 4—48" tables.
1—PANGBORN Model 6-GF, 6' diameter plain table with dust collector.
1—PANGBORN 6 LG-14 Multi-Table, 6-24" tables, w/dust collector
1—PANGBORN Model 14GK-7 Roto-Blast barrel w/loader.
1—PANGBORN 9LG-14 Multi-Table w/6—36" dia. Aux. Tables w/Dust Collector.

AAA MACHINERY & EQUIPMENT CO.

10900 CEDAR ROAD—CLEVELAND 6, OHIO—CALL SW 1-3900

Two *OUTSTANDING VALUES* from UNIVERSAL

SAND HANDLING SYSTEM

NATIONAL ENGINEERING UNIT

Consisting of: No. 1½ Simpson U.D. Muller with water meter, National Screen Master Preparator, Skip bucket loaders, 20" x 20' belt conveyor, Bucket elevator, Sand storage bin, 5 Moulder's hoppers.

1957 unit in LIKE NEW CONDITION
Dismantled in our warehouse
Yours for Less than Half of today's replacement value!

SPECIAL RESEARCH TOOL

30 KW ECCO VACUUM FURNACE

Complete High Frequency Vacuum Melting Furnace of latest design.
Consisting of: 30 KW M.G. Set; Ecco High Frequency Control Cubicle; Kinney Model KD-110 Vacuum Pump; Pyrometer.
Dimensions: 7½" dia. x 13" high furnace in water cooled vacuum chamber 31" inside dia. x 42" high.

1954 unit used only 54 hours
In LIKE NEW CONDITION

PARTIAL LISTING OF OUR REGULAR REBUILT MACHINERY STOCK

AIR COMPRESSORS
1—75 hp INGERSOLL-RAND water cooled, horizontal
1—100 hp WORTHINGTON air cooled, 2 stage

BLOWERS
25—CENTRIFUGAL 16 oz., 2 to 5 HP
10—GE, WILBRAHAM - GREEN, FISHER Positive Pressure & Cent. Cupola Blowers

CLEANING EQUIPMENT & TUMBLING BARRELS
1—15" Cont. WHEELABRATOR Tumblast
1—28" Cont. WHEELABRATOR Tumblast
1—18" x 20" WHEELABRATOR Tumblast
1—20" x 27" WHEELABRATOR Tumblast
1—27" x 36" WHEELABRATOR Tumblast
1—36" x 42" WHEELABRATOR Tumblast
1—48" x 42" WHEELABRATOR Tumblast.
1—48" x 48" WHEELABRATOR Tumblast
1—48" WHEELABRATOR Swing Table
1—1-A WHEELABRATOR Multi-table
1—WHEELABRATOR Peening Cabinet
1—PANGBORN TABLAST, 6' Table
1—PANGBORN Air Blast Room
1—PANGBORN PIPE CLEANING CABINET
1—SLY, 68" x 32" Round
4—SLY, 48" x 36" Round

CONVEYORS
1—HEWITT-ROBINS Oscillating, 18" W x 40' L
1—HEWITT-ROBBINS Vibrating, 18" W x 10' L, Model VC-I
1—LINK-BELT Bucket Elevator, 8" x 12" buckets on 14" rubber belt, completely enclosed by 2' x 4" casing.
1—LINK-BELT, CAR type mold, 114 cars, 403' track, car size 18" x 42"
1—SIMPLICITY, 24" x 10" Feeder w/hopper, Model OA-10-JA2

CORE BLOWERS
1—CHAMPION CB-5, Bench Type
10—DEMMLER #1, #2, #2A, #3K, #4E
3—INTERNATIONAL SB-13
3—OSBORN #91, #192, #91-10
1—RANDALL MODEL "A," Bench Type
1—TACCONE #4D, 10" Draw Stroke Cyl.

DUST COLLECTORS
COMPLETE STOCK—both Wet & Bag Type —send us your requirements

FURNACES—DIRECT ARC MELTING
1—250 lb. LECTROMELT, Side Charge
1—500 lb. LECTROMELT, 200 KVA trans.
1—1000 lb. SWINDELL
1—2000 lb. HEROULT
1—2000 lb. SWINDELL, 3/60 1000 KVA.
1—1¼ Ton HEROULT
1—25 Ton SWINDELL Hyd. Top Charge

FURNACES—INDIRECT ARC
1—10# DETROIT
1—60# DETROIT
1—350# DETROIT LFA
1—750# DETROIT LPY, Conical Shell,
1—1000# DETROIT AAD P, 300 KVA
1—3000# Detroit C, 500 KVA

FURNACES—INDUCTION MELTING & HEATING
1—35 KVA AJAX 60 cy., alum.
1—35 KVA, AJAX SPARK GAP, High Freq., steel
1—1250 KW 2 Ton Cap.
1—5KW G.E Tub- Type Induction Heater
1—30 KW LEPEL, water cooled spark gap

FURNACES—GAS & OIL
2—400# HAUSFELD hand tilt, Oil fired, alum or Magnesium
1—1 #900 JC STROMAN, gas, Like new
1—1200# Brass, MNP, Oil

FURNACES—HEAT TREAT
1—4' x 4' x 10' Gas Fired Annealing
1—9' x 12' Car Type, gas/oil
1—12" x 36" x 8" high HAYES "Certain Curtain"
1—7' Rotary G.E., 200 KW, 1950° F
1—36" x 36" WESTINGHOUSE Pit Type.

MOLDING MACHINES
Jolt Rollover Pattern Draw
1—HERMAN 10,000#, 48" x 109" table
1—HERMAN 6000#, 42" x 78"
2—HERMAN 7500#, 40" x 50" tables
1—HERMAN 7500#, 40" x 60" table
1—HERMAN 3000#, 30" x 66" table
1—HERMAN 3000#, 32" x 70", 15" cyl. series charging conveyor type
5—HERMAN 1500# to 30" x 48" tables
3—HERMAN 750#, 24" x 30" tables
1—INTERNATIONAL 30" x 12", Type G, 28" x 35" table
2—INTERNATIONAL, 13" x 17" tables
1—OSBORN #442, 21" x 31" table, 600#
1—OSBORN #602, 36" x 26", 900#
1—OSBORN #405, 3000#, flask size 64" x 57", 26" draw
4—TABOR 40" x 60", 1500 & 3000#
2—TABOR 30" x 40" w/air clamps, 1000#
1—TABOR 22" x 42", pattern draw, shockless, portable 600#
1—TABOR 20" x 30", w/air clamps, 1000#
2—TABOR 14" x 16" Rockover 150#
1—TABOR 40" x 50" table, 3000# capacity

Plain Jolt
1—INTERNATIONAL, 3' x 4' table, 12" cylinder

Jolt Pin Lift
1—HERMAN #4317, 22" x 30" table
2—INTERNATIONAL JDP, 1200 x 8", 24" x 26" table, 8" draw, 1200#, port.
1—J & J #681-C, 30" x 25" table, 600#
1—OSBORN #559, 25" x 30" table, 6" draw, 1200#
2—SPO #305, 750 lb., 20" x 27" table
1—TABOR 20" x 24" table, 600#

Jolt Squeeze Pin Lift
2—INTERNATIONAL PKL, 20" x 28" table, 14" sq., 5½" draw
3—INTERNATIONAL PKL, 18" x 24" table, 12" sq., 5½" draw, stat.
2—MILWAUKEE #163, 15" x 24" table, 11" sq. 1500#
1—NICHOLLS 18-44, 6¼" draw.
5—OSBORN #712J, #712PJ, 18" x 28" table, 12" sq., 6" draw, stat. & port.
5—SPO #2114P, 21" x 27" table, 600#
2—SPO #2116, 21" x 27" table, 11" sq., 6" draw

Jolt Squeezers
2—INTERNATIONAL #12 LJS, 16" x 20"
4—INTERNATIONAL #10 LJS, 16" x 20"
10—OSBORN #275J, 16" x 20" table, 400# port.
3—TABOR Squeeze-in Head, 16" x 19" table

MATERIALS HANDLING
1—BYERS, Mobile Crane, BUDA Engine, 50' Boom, 5 ton w/magnet & bucket
1—HOUGH PAYLOADER, Model HA, 1000# cap., hyd. lift, mech. dump

MULLERS AND MIXERS
1—B&P #30 Speedmuller w/skip hoist, 3 cu. ft. batch
1—B&P #40 Speedmuller w/skip hoist, 5 cu. ft. batch
1—B&P #3½ Mulbaro, 3½ cu. ft. cap.
1—B&P #60 Speedmuller, 10 cu. ft. batch
1—B & P, Conventional, SIMPSON type, 87½" Dia. arranged for cooling
1—CLEARFIELD #404, 4' Dia, 4 cu ft batch
1—CLEARFIELD #610, 6' Dia., 10-14 cu ft batch
1—SIMPSON #0, U.D. 3' Dia
1—SIMPSON #1, U.D., 4' dia., 4 cu. ft.
1—SIMPSON #2, 6' U.D. Dia. 14 cu ft
2—SIMPSON #3, enc. gear, 20-25 cu. ft.
1—SIMPSON #3, 8' Dia. Open Gear, 20-25 cu ft batch

LADLES
Bottom Pour
4—MODERN, 49" x 49"
2—MODERN Crane Type, 55" H x 50" top
1—MODERN Crane Type, 60" H x 60" top
Lip Pour
1—WHITING 40" x 40" top dia. geared
1—WHITING 52" x 52" top dia. geared
Cylindrical
8—WHITING, 26" L x 25" dia, 1100# iron
7—WHITING, 19" L x 22" dia, 600# iron
3—WHITING, 38" L x 28" dia, 2200# iron

OVENS
1—COLEMAN, Gas, 2 Comp. and 5 drawers, O.D 22" x 12' x 10'
3—GENRICH, Elec. elevator type. Inspection under operation in N.Y.C.—Excellent Condition

SAND CONDITIONING
1—AMERICAN Sand Cutter, Model AA, 62" cutting reel
1—B & P Nite-Gang
2—B & P Screenarator, Model "S" & "M"
1—LINK-BELT Revivifier
1—MOULDER'S FRIEND, 50" cutting reel
2—ROYER NC-2, 10-15 tons/hr, 1½ HP
1—ROYER NC-4, 10-15 tons/hr. 1½ Hp
1—ROYER PREPARATOR, Comb. Model NDC, 25 ton/hr scrap removal, 8' x 8' hopper
3—ROYERS, NDP, 15-25 tons/hr, 2 Hp
1—SIMPLICITY Type SORC 4' x 8' screen
1—ROYER Jr., 7-10 tons/hr., ½ Hp

SAND SLINGERS
1—B&P Stationary, 2 speed, 19" head, 4" tip with plate feeder
1—B&P Stationary, Single Speed
2—B&P Tractor Type 16" head
1—B & P Tractor Type, 19" head

MISCELLANEOUS
1—BLASTCRETE Model PM-1 Cupola Gun
1—200 KW, 230 volt D.C. MG Set
1—KANE & ROACH WIRE STRAIGHTENER Model DX-5
FLASKS, CORE PLATES, All Sizes
1—CLIMAX Model 2-A Wire Straightener
10 or 15 HP GRINDERS, Swing Frame
8—GRINDERS, Double End, Pedestal Type, 17 & 6in., Gardner, 5, 7½ & 10 HP
1—62" Magnet

UNIVERSAL MACHINERY AND EQUIPMENT CO.

1632 N. Ninth St., Reading, Pa. Phone: FRanklin 3-5103

Send for Our Illustrated Catalog

THE ACME BARGAIN PAGE

AIR COMPRESSORS
Binks 2 Stage, 2 h.p.
CHICAGO Pneumatic 300 h.p. synchronous, 4160V
INGERSOLL-RAND 2500 dfm, Steam, 1951

AERATOR
NEWAYGO

BELTING
29" x 180' 24" x 152'
24" x 263' 24" x 120'

BLOWERS
I.-R. 12900 cfm, 100 h.p. 220-440 V, 20 oz.
GE 10500 cfm., 20 oz., 85 h.p., 220 V.
GE 7500 cfm., 20 oz., 89.6 h.p., 220-440 V.
SPENCER 7350 cfm., 16 oz., 50 h.p.
SPENCER 7000 cfm., 32 oz.
GE Centrifugal 6200 cfm., 24 oz., 58 h.p.
SPENCER 3500 cfm, 28 oz., 40 h.p.
SPENCER 2250 cfm., 16 oz., 15 h.p., 220 V.
SPENCER 1350 cfm, 32 oz.
NORTH AMERICAN 1050 cfm, 16 oz.
NORTH AMERICAN 850 cfm.
McKee 200 cfm.

BUFFERS
STANDARD 20 RSB 20 h.p.

CLEANING EQUIPMENT
Model 4836V-B VAPOR BLAST

CONVEYOR
17' BARBER GREEN Bucket Conveyor
30" x 25' Magnetic Belt Conveyor w/drives, 2 hp., 220-440 V.

CONVEYORS OSCILLATING
SIMPLICITY 18" x 24'
SYNTRON 24" x 6'
AJAX 12" x 20'6"

CORE BLOWERS
CB15 55 # cores, Universal blow plate
DEMMLER #4 up to 250 # cores
DEMMLER #55
DEMMLER 2EO
DEMMLER 2K
FEDERAL "SAN-BLO" CB 4C
INTERNATIONAL SB15H, up to 150 # cores. Hydraulic clamp and draw
INTERNATIONAL SB 13, up to 60 # cores
6—OSBORN 193 up to 50 # cores

CORE GRINDERS
5—MILWAUKEE 70-9 & 70-12s
1—OWOSSO DE1-303 42" table

CORE OVENS
THERMONIC INDUCTION MODEL 1800A
3—Despatch ET, Drawer Type

CORE ROLLOVERS
INTERNATIONAL REDP Rollover 12" draw

CRANES
P&H 3 TON Electric Traveling DC motors 50' span
270' Crane Runway and Supports
10 ton MILWAUKEE; 48' span, 220 V.

CUPOLA GUNS
1—Bondactor #1250 and 1000

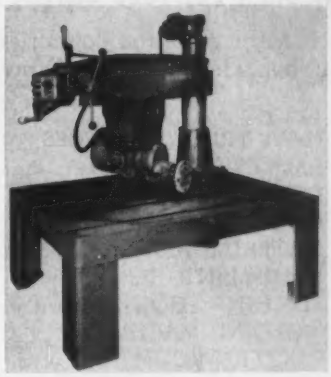
DUST COLLECTORS
PARSONS 40,000 cfm. cloth bag type
ROTOCLONE W14 Arrang. A. 5200 cfm.

ELECTRIC MELTING FURNACES
1—DETROIT "LFA" 350 # shell 13200 V.
1—DETROIT "LFC" 700 # and 350 # Tapered Shell 2300 V.

FURNACES
400 # Fisher Motorized Tilt, Gas Fired
600 # Fisher Stationary
600 # Campbell Hausfeld Brass

FURNACE TRANSFORMERS
1—"LECTROMELT" 800 KVA, 12000 V. 3 phase
PENNSYLVANIA 750 KVA, 13200 V., single phase
1—WESTINGHOUSE 500 KVA, 11200 V., 3 phase
1—WESTINGHOUSE 2500 KVA, 13800 V., 3 phase

GRINDERS, MISC.
U.S. #70 Comb. 20" disc & 20"x3"x1½" wh
GARDNER 18" single end disc.
HANCHETT 30" double spindle opposed
GARDNER 26" D.E. Disc.
GARDNER 30" D.E. Disc.
STANDARD 24" x 3" wheel Snag, 2-7½ h.p. motors



DEWALT CUTOFF SAWS for ferrous or nonferrous metals, cutoff or as sprue cutters. Flush blade adaptor takes up to 20" abrasive blade or saw. Power Hoist to arm. Chain & sprocket cross feed for working on heavy cast iron 48" x 60" "T" slot table or off table cutting of large work. Motor swivels horizontal to vertical in yoke.

GRINDERS, SNAG
Marschke 30" x 3", 3 speed snag
120A GARDNER 30" Opposed Disc
35A Standard D.E., 24" x 3" Wheel; (2) 7½ hp motors
U. S. D.E., 20" x 3" Wheel, 15 h.p.

GRINDERS, SWING FRAME
FOX 24" x 3" x 12", 15 h.p.
MARSCHKE 24" x 3" x 12" 20 hp., 220 V.
U.S. 24" x 3" x 12" 15 hp., 220-440 V.
2—MARSCHKE 3 hp., 12" wheel
1—B&D 7½ hp.

HEAT TREATING FURNACES
HOLDEN #202 Electrode Type, Bright hardening annealing 1850°

HOISTS
2—4000 # Lo Hed, 220/440V
1—500 # INGERSOLL-RAND LC-4
4—CLEVELAND 2000 # Cab type hot metal carriers
6000 # Cleveland, w/monotractor travel
4—2000 # Ingersoll Rand Hoists

INDUCTION MELTING EQUIPMENT
100 KW-Ajax 300 # 3000 cycle, 150 h.p. 4 bearings MS set, water cooled, complete controls
30 KW Lepel Spark Gap
35 KW Ajax Tama Wyatt, 60 cycle induction holding furnaces
1000 # Ajax Spare Melting Furnaces—Unused

LADLE MIXING
4000 # Industrial, Insulated

MOLD BLOWER
TACCONE TD4 24" x 32" flask

MOLDING MACHINES
JOLT SQUEEZE PIN LIFT
2—OSBORN 712 PJ 18" x 28" table
1—CHAMPION J8L10P 18" x 21" table 6" draw
9—MILWAUKEE 2646 Jolt Squeeze Strip rolloff — rolling molding machines 10" jolt cylinder; 1800 # capacity, 26" Squeeze cylinder; 13" draw, Flask size 25½" to 29" wide, 52" long. FACTORY REBUILT.
113 PJ SPO
2—MILWAUKEE 165, 24" x 30", 8" draw

JOLT SQUEEZERS
4—CHAMPION, J810P 18" x 21" table
2—OSBORN 275PJ
2—MILWAUKEE 244 Jolt Squeeze car type head
MILWAUKEE 181-7, 24" x 36" table
104 MILWAUKEE
10"—32 Adams

JOLT ROLLOVER DRAWS
HERMAN 10000 # late
HERMAN 3000 #
2—750 # HERMAN 20" x 30" table
1—INTERNATIONAL RJ 20" x 12"
1—SPO 9032

JOLT SQUEEZE ROLLOVER DRAW
2—#331 OSBORN 24" x 30" flask area, 7" draw

JOLT PIN LIFTS
MILWAUKEE 3000 #, 38" x 42"
INTERNATIONAL 600 x 8, 20" x 22" table, 8" draw

PLAIN JOLT
40" x 84" Herman
36" x 60" Herman
2—20" x 30" INTERNATIONAL

MULLERS and MIXERS
2—#3 UD Simpson
1—930 Clearfield
CLEARFIELD #404

SAND CUTTERS
AMERICAN 51"
JEFFREY SANDITIONER
ROYER NDP, 2 h.p.

SAND SYSTEMS
2—NEWAYGO SUPER HANDY SANDY: like new

SAWS, BAND
30" LAIDLAW, Metal Cutting hydraulic feed

SHAKEOUTS
3' x 5' SIMPLICITY
3' x 10' SIMPLICITY
7' x 8' SIMPLICITY SOM14

SHELL EQUIPMENT
SHELL PRODUCTS 20" x 30" pattern size w/shell blender and bonding press TSM4 Shell Molding Machine 20" x 30"

SHOT BLAST
SLY #4, 20" x 30" w/dust collector

SLAG DISPOSAL UNIT
AMERICAN MODEL A

SPRUE CUTTERS
1—MILWAUKEE #85 TON

STRAIGHTENING PRESS HYDRAULIC
150 ton HPM
150 ton Farquhar "C" Frame
100 ton Watson Stillman "C" Frame
60 ton Lempco 4 post
60 ton Farquhar "C" Frame

TESTING EQUIPMENT
ARLIN Automatic Rockwell, continuous type
60,000 # BALDWIN SOUTHWARK Tensile Tester
COLEMAN 55 Spectrophotometer
GOGAN Model 1414-2V
TYLER ROTAP Testing Sieve w/screens
TINIUS OLSON Brinnel Hardness Tester Production Bench

TUMBLING BARRELS
1—ROYERSFORD, 42" x 72", chain drive, late
SLY, 24" x 48"; 3 H.P.
SLY, 30" x 60" Duplex.

WHEELABRATORS
27" x 36" American w/skip
2—20" x 27" AMERICAN, w/rubber belt
1—42" x 48" AMERICAN Skip Loader.
AMERICAN #2 Tabiast 8-28" tables, late
PANGBORN LD1-Airblast Table
PANGBORN GD1-Airblast Barrel

WOODWORKING—PATTERNSHOP
GARDNER 30" DISC and Spindle Sander
HERMANCE 24" Planer
JONES SUPERIOR 48" Double Disc
BOICE CRANE 12" Planer
OLIVER #290 Dbl Arbor, Tilt-Arbor Saw
1—OLIVER 182D, 15" Disc Sanders
WALLACE 8" Jointer
CRESCENT 24" Planer
ONSRUD W-244 & W-240 Routers
8", 12" and 30" Jointers

WIRE STRAIGHTENERS
B-21-Multiplex Wire Bender & Cutter

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Facilities of one of the largest, modern grey iron foundries in the country, consisting of: Foundry, Machine Shop, Pattern Shop, Heat Treating; Office and Material Handling Equipment.

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CUPOLAS
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GRINDERS
HEAT TREAT FURNACES
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MOLDING MACHINES
PATTERN ROOM
EQUIPMENT
SAND HANDLING SYSTEM
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SAND BLAST EQUIPMENT
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STEEL APRON CONVEYORS

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a name to trust . . .

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in Metropolitan St. Louis

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JOLT SQUEEZERS
International PJS-16"
International LJS-10"
Milwaukee 103
Osborn 275JW and 275J
SPO 110J
Tabor Top Squeezers
Tabor Strand Rod

JOLT SQUEEZE ROLLOVER DRAW
SPO 920
SPO 413D
Osborn 332

JOLT ROLLOVER DRAW
International F
International G 30 x 12
SPO 506
Tabor 30 x 50
Tabor 16 x 22
Herman 40 x 60—10,000#

JOLT PIN LIFT
Davenport 34A
Osborn 559
Milwaukee 1536

JOLT SQUEEZE PIN LIFT
International PKL14
Osborn 712PJ
Milwaukee 125
Milwaukee 126

MULLERS
B&P 60—Multrolmatic
Simpson #3 with skip hoist
Simpson #2 Skip & Aerator
Simpson Number 2 Unit Drive Sand Muller With Skip Hoist Areator And Water Meter

AIRLESS BLAST EQUIPMENT

Wheelabrator 48 x 72 with skip and dust collector, excellent condition.
American 66" Swing Table
American 8' Plain Table with collector, excellent condition

Wheelabrator 27 x 36 with skip.
Wheelabrator 42 x 48 with skip & collector
Wheelabrator 36 x 42 with skip & collector
Pangborn #3 continuous with feeder & collector
Pangborn 8LF Plain Table

CORE BLOWERS

Demmler 103EO, skip, feeder & automatic cycle
Demmler 3EO, feeder & semi-automatic cycle

Demmler #1 and 2, #55 and 2K
San Bio CB-40-D-LPP
Redford #1 & 2
Champion CB-8 and CB-15 and CB-18 (Never used.)

CORE OVENS
Coleman 39' tower combination oil & gas
Porbeck double end gas or oil

SAND CONDITIONING AND HANDLING

Two Twin Hopper Handy Sandys
One Single Hopper Handy Sandy

Screenarator S, M, L.
Royer NDP
American Sand Cutters — various sizes.
Bucket Elevators
Troughing Conveyor 16" x 34' w or w/o magnetic pulley.
Oscillating Conveyor 24" x 30' year 1956.
B & P No. 60 Preparator

MATERIAL HANDLING

Hough HA Payloaders, Forklifts 2000#, 4000#, 6000#, 7000#, Handling Boxes.

Hough HA Payloaders
Forklift Trucks and Handling Boxes
1 Yard Clamshell Bucket
1½ Yard D.C. Clamshell Bucket
Hoists Air and Electric
Champion CB-8 and CB-15 and CB-18
Crane Magnets 39", 50" and 55"

METAL HANDLING
Ladles 250#—10,000#
Pouring Devices, various capacities
Motorized Ladle Carrier
12" Cleveland Tramrail

AIR COMPRESSORS
10, 15, 25, & 75 hp air cooled
175 hp synchronous, 2 stage IR-XRE

MISCELLANEOUS EQUIPMENT
Foxboro Air Weight Controllers
Grinders, 18" x 24"
Detroit Hardness Testers
Flasks, Steel, various sizes
Flasks, Aluminum Slip
Flasks, Fremont Magnesium Slip
Jackets, Aluminum & Wopper Jaw
Core Plates—Aluminum & Transite
Cupolas, 1½, 2½, 5, 6, 7, 8, 9 and 10
American Core Rod Straightener

42" Bullard "New Area" VTL lathe with side head
52" Betts Boring Mill with two loading arms.

FOUNDRY ENGINEERING SERVICE
WANTED! GOOD SURPLUS EQUIPMENT

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Main 1-8260

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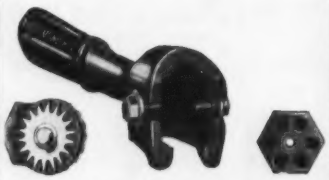
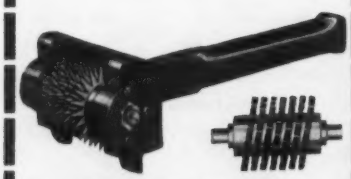


Desmond Hex Dresser

LIVES FOR FOUNDRY GRINDING WHEEL



Desmond Heavy Duty Dresser

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Desmond

Desmond-Stephan Mfg. Co.

Urbana, Ohio

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HARDER-FASTER

when conditioned with the

AQUADYNE SYSTEM

The water you use in (1) sand conditioning, (2) core and mold washes, (3) cupola linings, and (4) CO_2 core cleaning has greater penetration and dispersion when conditioned in the simple AQUADYNE way, thus...

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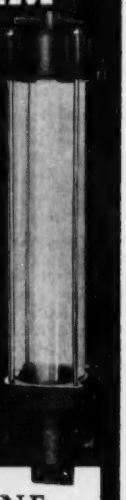

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89 TERMINAL AVENUE

CLARK, N. J. • FUlton 1-3036

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Graduate Illinois Institute of Technology. Economics; Major in Math. Graduate work in Math., Michigan State U. Quality Control Engineer—Statistician. Formerly with Western Electric Co., Chicago.

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B.S. Metallurgical Engineering, University of Michigan 1950. Formerly, operating Metallurgist and General Foreman Chevrolet Gray Iron Division, G.M.C. Presently Plant Metallurgist, Engineered Castings Inc.

EGGHEADS

IN THE FOUNDRY?

Not many years ago, "eggheads" like mathematicians and statistical analysis engineers were strangers in foundries. Today, however, the basic foundry industry has evolved from an artisan's craft to a highly scientific, technological field. It requires engineering talent in many areas such as electrical, mechanical, metallurgical, and statistical engineering.

Engineering Castings Inc., Marshall, Mich., provides an excellent example of the technical and scientific nature of the modern foundry industry and the high degree of knowledge required of its technical personnel. ECI sometimes is referred to as the "prescription-counter" foundry because of the number and complexity of the alloys it runs to produce a wide range of quality castings for engineering applications in many industries.

At Engineering Castings, castings are produced, under strict process and quality control methods, to exacting metallurgical specifications, physical standards, and dimensional tolerances. Some castings even are produced to a metallographic go, no-go requirement. Controlled microstructure must be held within two limits metallographically. Nature, size, and distribution of the graphite and carbides and the matrix itself are held to tight specifications.

Two of the younger engineers on whom Engineering Castings relies for the high degree of specialized knowledge necessary to meet these quality standards are pictured here.

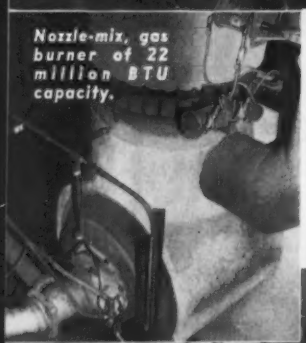
The Foundry Educational Foundation—created by and for the foundry industry—provides the principal source of critically needed engineering and scientific personnel. Availability of an adequate supply of technical manpower depends on your support. You can become a partner in engineering progress in cast metals by participating in the Foundry Educational Foundation.

Foundry Educational Foundation

1138 TERMINAL TOWER BUILDING • CLEVELAND 13, OHIO

The Foundry Educational Foundation does not pay for this advertising. This advertisement has been prepared and the space contributed by FOUNDRY magazine in support of FEF's constructive program for foundry industry progress through education.

MODERN WATER-COOLED CUPOLA OPERATION . . .

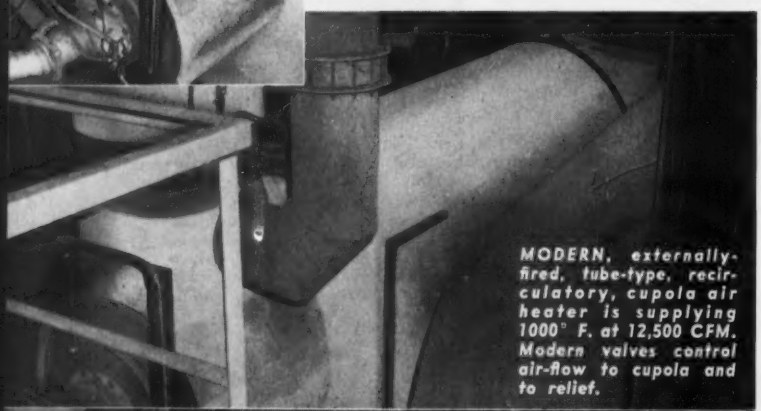


Nozzle-mix, gas burner of 22 million BTU capacity.

Modern, #96 W-C, water-cooled cupola is 96" dia. in the carbon-lined, offset well. Cupola is fired by 1000° F. Modern heater. Melting progresses continuously; 5 days a week and 24 hours daily.

EFFICIENCY BOOSTED BY 1000° F. RECIRCULATORY HEATER . . .

Again, the nation's melting costs are boiling down! NOW, MODERN, economical and highly flexible water-cooled cupolas are fired by new, MODERN, recirculatory, hot-blast heaters:



MODERN, externally-fired, tube-type, recirculatory, cupola air heater is supplying 1000° F. at 12,500 CFM. Modern valves control air-flow to cupola and to relief.

Back of #96 W-C, MODERN cupola. Master control panel at left.

Blast air, to 1000° F. and in volumes to 12,500 CFM is helping to cut coke ratios while producing better metal, for ingot-molds, at Vulcan Mold & Iron Company, Lansing, Illinois. Among the major advantages, as gained at Vulcan are:

- Flexibility and fine control over melting processes . . .
- Prolonged periods of melting without dropping bottom . . .
- Decreased costs for coke, refractory and maintenance . . .

Melting, at Vulcan Mold & Iron Company, progresses continuously from Monday morning until Friday night. All these and other benefits are covered in new bulletin 149-A.

MODERN

Dept. F-4

MODERN EQUIPMENT COMPANY

Port Washington, Wisconsin

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STEVENS GRAPH-Z CORE WASH

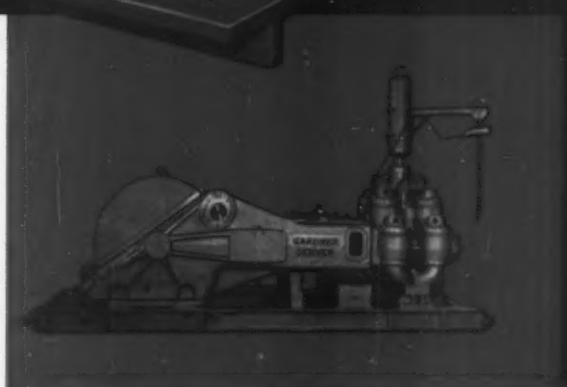
CUTS CLEANING ROOM COSTS AT GARDNER-DENVER

- Eliminates metal penetration and sand burn-in
- Assures clean peel of sand from castings
- Leaves no white surface film on finished castings

Cope and drag cores for slush pump bases weigh approximately 10,000 pounds.

The Gardner-Denver Company, world-renowned manufacturer of oil field equipment, depends on Stevens Graph-Z Core Wash to produce smooth, clean castings for its famous deep-drilling slush pumps. The result: better castings that require fewer cleaning-room operations prior to final finishing!

Write today for information on Stevens complete line of core washes and other foundry products. Or, contact your Stevens representative . . . he'll show you how you, too, can produce better, cleaner castings and reduce overall foundry costs!



Gardner-Denver Model GXP Deep-drilling Slush Pump.

EVERYTHING FOR THE FOUNDRY

frederic b. STEVENS, inc.

DETROIT 16, MICH.

BUFFALO CHICAGO DETROIT CLEVELAND
INDIANAPOLIS MILWAUKEE NEW HAVEN SPRINGFIELD (OHIO)

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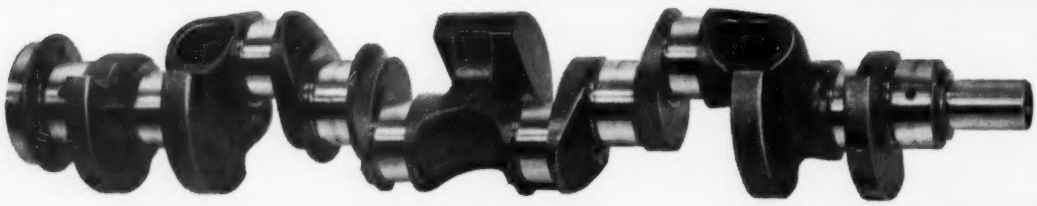
FORD'S FALCON CRANKSHAFT...



SHELL MOLDED EFFICIENTLY WITH RCI FOUNDREZ RESIN!

Ford is mass-producing Falcon crankshafts by the shell mold process – a method as modern as the compact car itself.

And an RCI phenol-formaldehyde FOUNDREZ resin is used extensively to produce the shell molds for this important Falcon casting.

This combination of process and resin provides an economy born of efficiency. Here's why!

The shell mold process offers specific advantages:

- pattern dimensions can be reproduced more exactly
- castings have closer tolerance, require less machining
- shell molds are portable and use less sand
- in fact, foundry efficiency, flexibility and production rate are increased

And RCI FOUNDREZ resins are ideal for shell mold applications because:

- RCI is a basic producer of both phenol and formaldehyde, which guarantees quality control from raw material to finished product.
- RCI's experience, gained during 35 years of diversified synthetic resin manufacture, assures expert technical service.

The advantages of shell molding may apply on one of your foundry jobs. Write to RCI Foundry Division for detailed information on FOUNDREZ resins.

Creative Chemistry ... Your Partner in Progress

REICHHOLD FOUNDRY PRODUCTS

FOUNDREZ – *Synthetic Resin Binders*
COROVIT – *Self-Curing Binders*
coRCIment – *Core Oils*
CO-RELEES – *Sand Conditioning Agent*
REICOTE – *Sand Coating Agent*

REICHHOLD CHEMICALS, INC., RCI BUILDING, WHITE PLAINS, N.Y.

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